

Teaching number  
skills to children with  
Down syndrome  
using the Numicon  
Foundation Kit

Joanna Nye

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# Teaching number skills to children with Down syndrome using the Numicon Foundation Kit

## Introduction

This book aims to provide teachers and parents with a guide on how to adapt the Numicon system for teaching number skills to children with Down syndrome. It is based on the findings of an action research project that has taken place in Portsmouth over the past three years, and from discussions with teachers and parents around the world who are using Numicon.

## The content of the book

The book describes suggestions for how the Foundation level of the system can be adapted for children with Down syndrome, and is illustrated with case study examples. It is assumed that the reader has a Numicon Foundation Kit, is familiar with the basic ideas of the system, and reference will be made to the Numicon Foundation Activity Cards throughout. Please note this book cannot be used as a replacement for the Numicon teaching system. The ideas and advice in this book are intended to supplement the Numicon activities. In the main, the additional activities break tasks into smaller steps or adapt activities to take account of the learning style of children with Down syndrome. References and a resource list are included at the end of the book.

By sharing experiences gained over the past few years it is hoped that these will help others in exploring the use of the system, however this should not restrict the way that readers should use Numicon and we would encourage you to use the materials in a creative way that appeals to your child. Many of the ideas suggested would be applicable to a wide range of children using the system, not just those with Down syndrome.

## Using Numicon with children with Down syndrome

Numicon gives a clear visual representation for number which is thought to support the visual style of learning that is usually a strength in children with Down syndrome. As well as being a highly visual resource there is an overall emphasis on multi-sensory teaching in the system which is thought to be of benefit, and the fact that the children can manipulate the materials themselves is a key strength.

For more details on the research on number skills and the specific cognitive profile of children with Down syndrome please see the *Down Syndrome Issues and Information* books by Sue Buckley and Gillian Bird listed in the Reference List. References to research investigating Numicon both with typically developing children and children with Down syndrome are also listed.

Evidence that Numicon can be a useful resource for teaching number skills to children with Down syndrome has been provided by case studies (Buckley, Horner, Wing and Bird, 2001; Horner, 2002; Uttley, 2003; 2004), by a small study in Wiltshire, UK (Ewan and Mair, 2002) and the Portsmouth project, which will now be described.

## The Portsmouth Numicon Project

The aim of the project was to conduct an in-depth evaluation of the Numicon system as a tool for teaching number skills to children with Down syndrome and to provide practical suggestions as to ways in which the implementation of the system could be improved. Initially the project was set up to run for one year during which time 16 children with Down syndrome were taught maths in school using the Numicon system, and the key results from the study are presented here. The children were assessed on standardised measures of number at the beginning and end of the project, and this data was compared with archive data on children with Down syndrome who had not used Numicon. The children were visited several times each term during the year, to observe Numicon being used and to help teaching staff with any adaptations that were required. Workshops for teaching staff and parents were held three times during the year to share experiences.

### Evidence of an overall group benefit

The children's scores on standardised number measures showed that children with Down syndrome who used Numicon made better progress on their number skills in one year than children with Down syndrome not using the system. However, the difference was not statistically significant. It is possible that this lack of a significant effect was due to the small numbers of children involved and limitations of the measures used to assess number skills.

### Individual differences

The investigation of individual differences from case studies of each child who used Numicon provide evidence that none of the children using Numicon made no progress in using the materials and all children developed their general number skills. The exception to this was one child who made progress on the Numicon activities, but did not seem to make noticeable gains in more general number skills (e.g. object counting did not improve). This child had significant behaviour difficulties which were the main focus for the school staff during the year. Numicon was one activity that he successfully engaged with and the staff were very positive about using the materials with him.

There was no evidence that use of the materials caused any negative impact on the children's number development.

### Valued by all schools

After the first year of the study, all the schools involved were planning to continue to use Numicon, except one school with a child who no longer needed it, and all were positive about what had been achieved with the materials during the year.

## Key message for using the system effectively

Benefits of using Numicon with the children seemed to depend on regular and creative use of the materials, where the children could see the connection between the materials and their other number experiences. Therefore, the system should not be seen as a 'magic wand' that will improve numeracy skills with basic implementation, but must be made relevant to the individual child concerned in order to assist generalisation of skills.

## Overall conclusions

In summary, from the findings of the study, the key benefits of using Numicon for children with Down syndrome in the classroom are:

- The materials and methods clearly support the development of early number concepts, and in particular the ability to calculate – for some children, using Numicon enabled them to develop these skills for the first time
- It enables teaching staff to 'see' what the child is thinking, which is important for identifying both successes and confusions in the child's understanding
- It can be used to support everyday number skills such as time and money
- It is especially beneficial to children who use a visual and/or multi-sensory approach to learning
- Children are motivated to engage with the materials as they are so attractive, and they develop confidence in maths work as they can succeed with the materials
- The clear structure of the teaching system is useful for teaching staff looking for a way to differentiate the numeracy curriculum.

The benefit of using the Numicon approach was seen most clearly at the stage when the children were learning to manipulate numbers – to add, subtract and multiply. This might be expected as Numicon is intended to support a real understanding of the values of numbers and the relationship between them. In addition, for some children in the current study the materials also provided a boost in earlier number skills as observed in the classroom, but these effects were not so clearly seen in the standardised test results, as the test items were not sufficiently sensitive.

For further details on the results of the first year of the Portsmouth Numicon Project please see the article by Nye, Buckley and Bird (2005).

Further funding allowed the children to be followed for another year and the results from this second year are currently being analysed and will be published as soon as possible (see downsed online at <http://www.downsed.org/research> for news on this).

## Adapting Numicon for children with Down syndrome

If you have not already done so we would recommend looking the Foundation Teachers book and the Foundation Activity Cards before reading the following section, as it assumes familiarity with the system.

### General principles

Some of the advice given here will already be found in the Numicon teaching guides and Activity Cards, however we feel it is worth emphasising those points that particularly apply to children with Down syndrome.

## Allow time to play with materials

The teaching books emphasise allowing the children to have time to play with the materials before attempting the structured activities described on the activity cards. It can be tempting to miss this aspect of the system, but it is important to allow the children to explore the materials in their own way so they become familiar with them, and enjoy using them.

## Allow exploration of the materials when working on a specific activity

Even when you are working on a specific activity the materials allow the children to explore their own ideas and they may surprise you with what they demonstrate to you.

For example, one 5 year old had been working on matching the 1-8 shapes to the Numicon numberline, and then surprised his teaching assistant by pointing to the 9 and 10 on the numberline and then finding the corresponding shapes. In the next teaching session while working on Activity 3 – Find the Shape, he then started to show interest in the ‘odd’ shapes by pointing to the odd shape sticking out. Another 9 year old while doing ‘Cover the Board’ (Activity 2) asked “Does 3 add 1 make 4?”.

## Working through the system

It is recommended that the child is able to complete each activity competently before moving on to the next activity as there is a careful structure to the system which gradually builds skills and understanding. We have observed some children having difficulties with more advanced skills when they have worked too quickly through the earlier activities, so it is important to avoid the temptation to get on with the ‘proper maths’ activities and skip through the early activities too quickly.

However, we have found that some children need to work on a few different activities at once to keep their interest. It can also be useful to include both familiar (maybe as a warm-up to the session) and new activities in a teaching session in order to keep them engaged as well as making progress with new skills. Therefore, a balance needs to be struck between working through the activities one-by-one in order and selecting a few to work on at the same time. Once a Numicon activity is well practised it is important to practise the same skill with other materials to aid generalisation.

The key to introducing any new activity to work on is to make sure that any activities that develop prerequisite skills have already been worked on and that these skills are well-learned. For example, Activity 7 – Jumbled Shapes should only be tackled once your child is able to match the shapes as is presented in Activity 1 – Match the Shapes.

The following has often worked as a good starting point for children with Down syndrome:

- Activity 1 (Match the Shapes) – using 1-4 shapes
- Activity 2 (Cover the Board) – using overlays if needed
- Learning to say the standard count word sequence by rote using visual supports (see the section on learning the count words sequence on page 12), and learning to read the numerals
- Counting set of objects
- Making patterns with a range of materials and noticing patterns in the world, such as threading beads making an alternating pattern with red and blue beads or arranging play fruit in patterns such as apple, banana, pear, apple, banana, pear, etc. (See the Numicon teachers books for more detail on the importance of pattern work and practical ideas.)
- Informal number activities that your child enjoys – singing number songs, games involving numbers and counting, talking about numbers that occur in everyday activities. You probably already do many of these.

The diagram at the end of the book may help guide you in selecting activities to work on, how to progress through them and in knowing when other skills are needed. The diagram shows where to start (as described above), and once your child has become competent with an activity which one to move onto next. If two or more arrows lead into an activity box then the activities that the arrows lead from must all be practised before moving onto that new activity. As well as the Numicon activities the diagram also shows where number skills that are not covered in the Numicon system need to be practised. These additional skills are described in more detail in the section starting on page 12.

## Demonstrate any new activity

Always demonstrate any new activity, rather than just talking through what needs to be done, to take advantage of the children's strengths as visual learners. Modelling the activity is a useful way of getting your child to understand what they are being asked to do. If your child needs support throughout an activity then taking turns as you work through the activity together is a good way to demonstrate or model what they need to do. Most of the Numicon activities can be taught by taking turns with your child (e.g. Activity 1 – Match the Shapes). Other activities work better if you each have a set of materials to work with and you both do the activities (e.g. Activity 7 – Jumbled Shapes), and some children prefer this way of working to turn taking for all the activities. Many of the activities work well with small groups of children, if this is how you are used to working, and the children provide useful models for each other.

As turn-taking is used in many of the Numicon activities this means that you continue to model the activity. It should be noted that modelling may help to get your child get started on a new activity but active child repetition or practice rather than watching may be needed for learning to take place.

## How to build in practice

To increase practice on a specific activity and maintain interest, the activity can be repeated using other materials as often as required. For example, arranging toy cars or plastic animals in the Numicon patterns to practise Activity 5 – Make a Pattern. This example is suggested on the Numicon activity card as a 'Challenge' activity and these suggestions provide useful ideas on how to repeat the activities using other materials. This is also important for applying the skills learnt using the Numicon materials to generalise to everyday number situations.

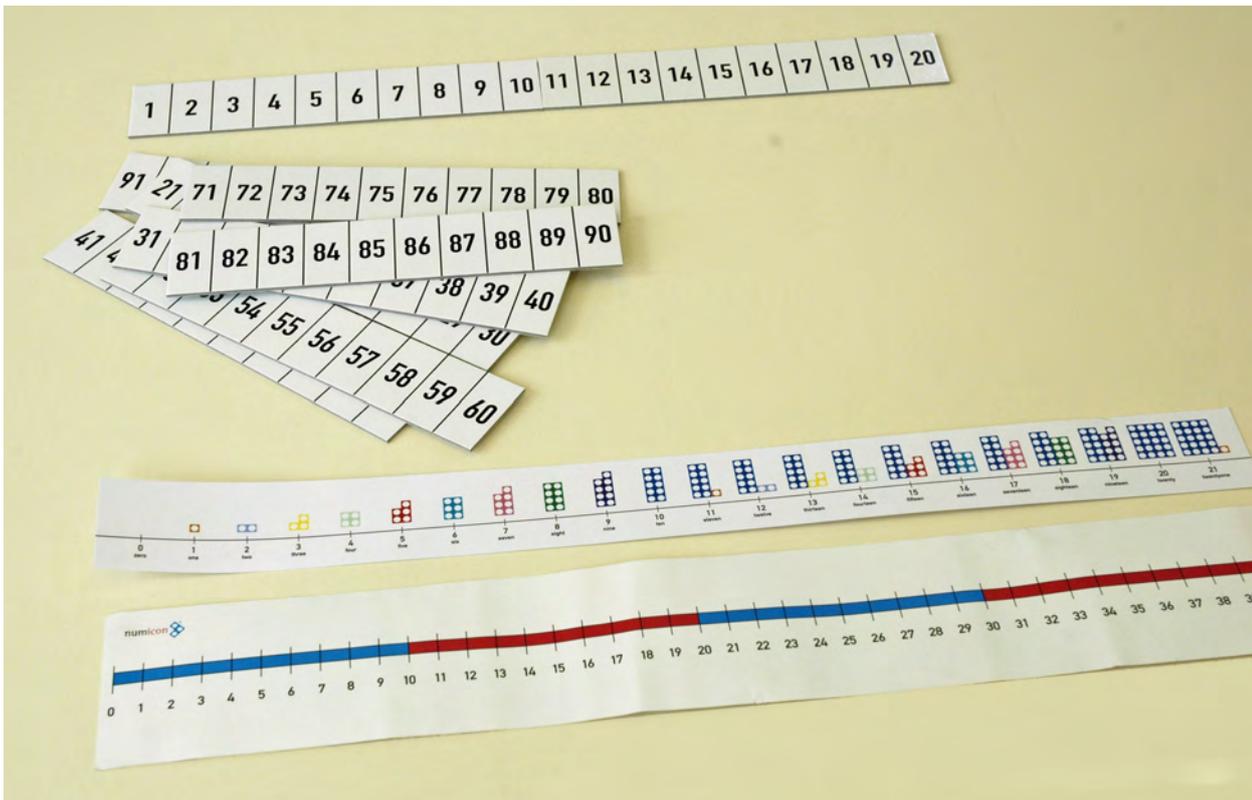
## Reduce range of shapes

At the start of presenting any new activity we would suggest reducing the number of shapes used in order to reduce the amount that the children need to attend to. This is mentioned in some of the Numicon activities (e.g. Activity 7 – Jumbled Shapes) however we would recommend making this adaptation with every new activity as it is presented and for the first few trials. Once the child has understood the idea of what is required then either introduce a few more shapes or the whole range depending on the child's confidence with the task and shapes. If necessary remove some shapes if presenting all of them in one trial is too much.

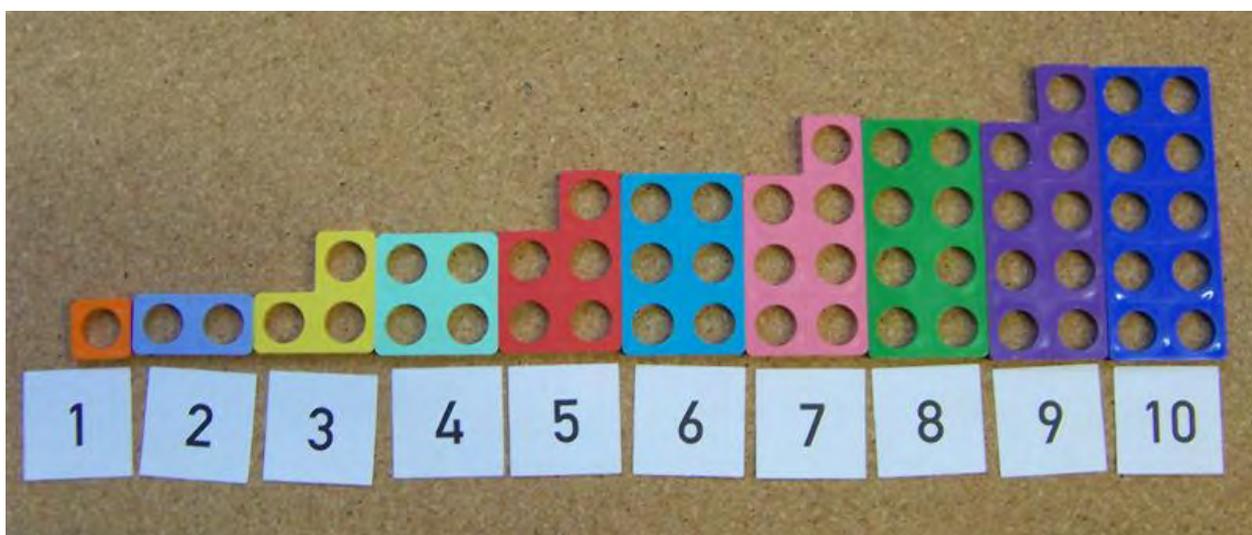
We would also recommend reducing the amount of all materials in the work area to a minimum to prevent distractions. It can be useful to have shapes organised in a divided box or cutlery tray so you and your child can locate shapes quickly and easily.

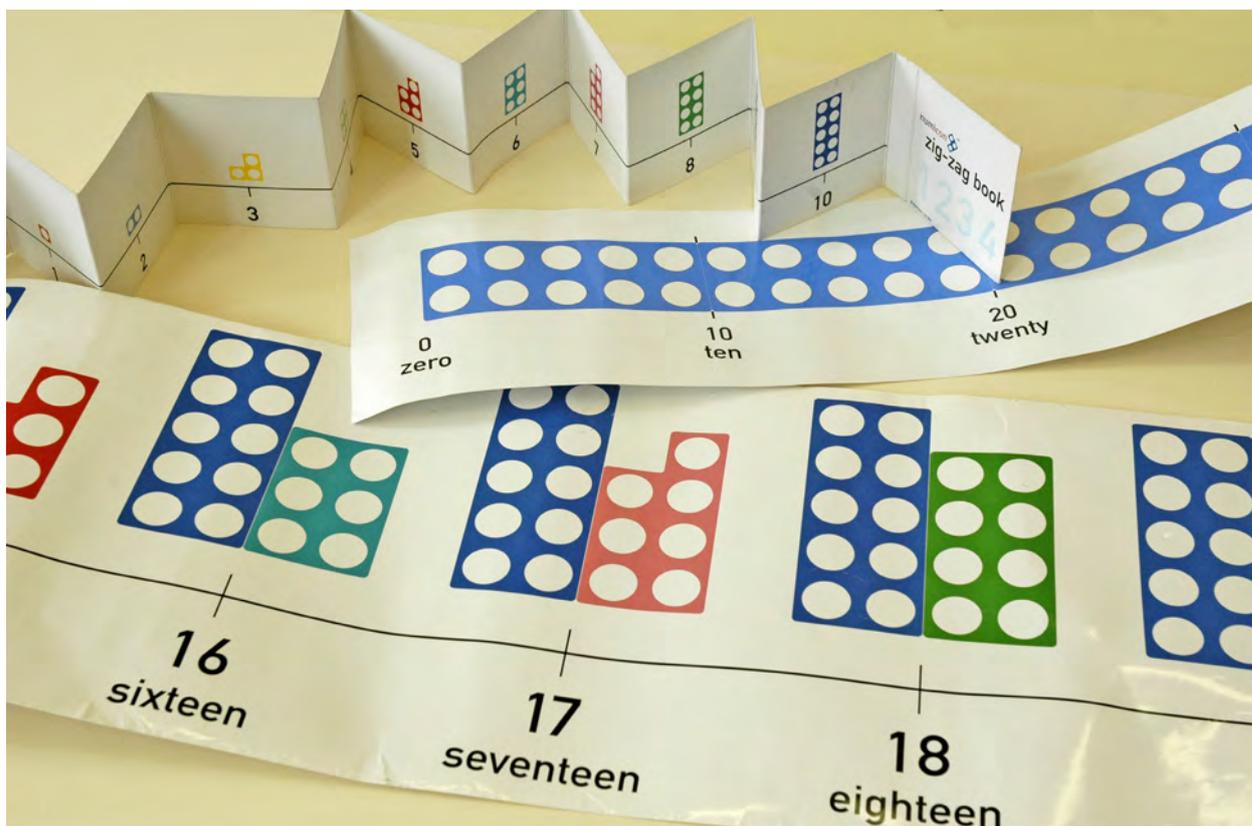
## Display a numberline

We would recommend keeping a Numicon numberline on display in front of the children's work area, so they can refer to it whenever they need support whilst they are learning (see illustrations on next page for a range of numberlines). For younger children the large wall numberline and the large tabletop num-



berline are both very useful, whilst older children can make use of the more portable table top numberline. Once your child is able to complete Activity 14 (Give It a Number) you could start each Numicon session by making the number line with shapes and numerals and leave it on display at the top of the table throughout the session, providing another version of a numberline.





### Smaller steps

The Numicon system was originally designed for use with typically developing children attending main-stream schools. It is an inclusive system, designed to work for all children. Many of the activities are not designed to be taught in one session for any child, but it is likely that many of the steps in the activities are too large for most children with Down syndrome, and so will need to be broken down into smaller steps. This will be very much dependent on the skills that the child brings to the activity, but where solutions to this have been found they are described in the main section of the book. Older children with Down syndrome are usually able to cope with the activities as they are set out, but again this will still depend on the individual child.

Some children will just need to start off with a reduced number of shapes to start the activity (e.g. 1-4) and then gradually extend the number they are able to work with until they can competently complete the activity with all 10 shapes.

Other adaptations may be needed, or pre-requisite skills worked on. For example, Activity 1 requires the child to be able to match one set of shapes to a model set of shapes, therefore they need to be able to complete matching activities before engaging with the Numicon activity – for example, picture or word matching. Recognition of colour words may need to be learnt, this can be done either as a separate activity or while engaging with the Numicon activities or both. Drawing round the shapes and colouring them in is a popular activity and can be used to learn the colour names, explore the shapes further and can be used as a way of recording some activities in maths books.

### More repetition

While the Numicon system does not specify how often an activity should be repeated, if you have used Numicon with typically developing children you are likely to find that your child with Down syndrome will need to repeat the activities more frequently in order to achieve mastery of an activity. We have observed a wide range in the amount of repetition that children with Down syndrome need to be able

to complete an activity – from those who are able to complete an activity on their first attempt, to those who need a few practice sessions, to those who continue working on activities for many months before the activities are well learned. Please see the case studies of children at the end of the book for more detailed examples.

## Challenge activities

The suggested challenge activities on the cards should be seen as additional points to try, or a source of how to vary the task. They can be used as a test to see how well the skills have been learnt, or as an extension activity to make the activity more difficult for the more able children. If your child cannot complete a challenge it should not prevent you from moving onto the next activity – but maybe note this and return to it later to extend their experiences further.

## Generalising Numicon skills

Ultimately Numicon is a tool which is used to aid children's development of number skills, therefore it is very important that children using the materials are able to develop skills and concepts that they can apply to novel situations involving number. To do this the Numicon authors strongly emphasise making connections between the activities and real life examples. They suggest using other materials to help generalise the skills learnt. This is especially important for children with learning disabilities as they are less likely to make such connections and generalisations for themselves. To maintain interest and motivation it is recommended that the activities are made relevant for the child using materials and topics they are particularly interested in.

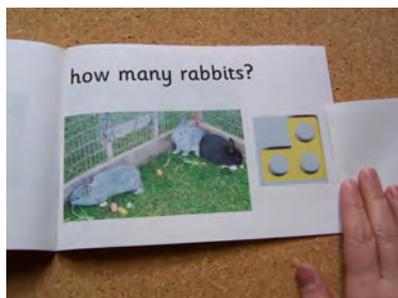
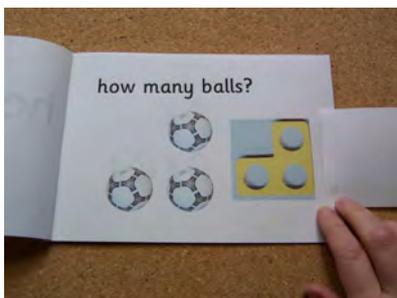
For example, one five year old was very keen on plastic animals so he used them to arrange into the Numicon patterns to generalise the learning of the patterns as set out in Activity 5 – Make a Pattern. An older child enjoyed making up addition and subtraction stories about toy people. He used the Numicon pegs to represent food and drinks that each person was given, and then worked out how many of each item had been given out in total. If the items were eaten, then subtraction problems were represented with the materials. Most activity cards



make suggestions on how to make connections with other materials, and we would recommend using Activity 25 (Make a Story) after as many activities as you can to help with generalisation.

As well as setting up activities that connect with an activity you have just completed with the Numicon materials, you may find you are able to start introducing the same ideas into everyday activities. This helps to demonstrate why the ideas introduced in the Numicon activities are useful and your child gets used to using the skills learnt with the materials to solve problems that occur. For example, counting out knives and forks into the Numicon patterns while laying the table, or grouping sweets into tens to help find out how many you have.

You may also want to make your own materials by scanning or colour photocopying the Numicon shapes to stick into number books, scrap books, or to put up on cupboards or up the stairs, in order to make the connection between the Numicon shapes and other things in the child's world. Wendy Uttley has



made individual number books for her son, with each book focusing on a different number (the photographs show some of the pages from her '3' book).

Further examples that have been successfully used with children with Down syndrome are described in the main section of this book where adaptations of each Numicon activity are set out.



## Feely Bag

Many of the activities are designed to help the children learn the patterns and be able to visualise or see the patterns in their 'mind's eye'. When they are able to do this and have built up a mental image of the pattern they will be able to use these images to help solve numerical problems. Using the Feely Bag is a key activity in helping children to develop this mental imagery; encouraging the children to mentally represent the shapes and patterns as they feel them without seeing them.

Many children with Down syndrome find feeling for a shape in the bag and identifying it without looking at the shape difficult, as many have difficulty linking touch and vision (e.g. identifying that the shape they are feeling is the same one that they can see). If this is the case for your child, we would recommend continuing to work on other activities, but as it is such an important activity try to gradually

introduce the Feely Bag. The following suggestions may help you to do this, and to solve any difficulties you may encounter.

## Ideas to try first

Before starting to use the Feely Bag it is worth spending some time focusing on *feeling* the shapes and describing them (you and/or your child can do this, depending on your child's productive language skills), either as a distinct game or whilst involved in other activities (e.g. Activity 1 – Match the Shapes or Activity 2 – Cover the Board).



Encourage your child to use both hands, both when feeling shapes they can see and when they are in the Feely Bag – this may mean making your own drawstring bag with a wider opening for older children to get both hands into the bag. One child with Down syndrome who had limited mobility in one hand was encouraged to hold the shape in that hand and then feel the shape with the other one.

Some children have been overwhelmed with this activity, and the difficulty was solved by reducing the number of shapes in the bag.

Some children just need to be prompted to slow down and take more time to feel the shapes before taking them out of the bag.

If it helps to stop the shapes from moving about in the bag either do the activity with the bag supported on a table, or attach some shapes to a piece of material using Velcro that can either be used on the table or in the Feely Bag.

Another reason that some children with Down syndrome have difficulty with the Feely Bag is a dislike of putting their hands into a cloth bag – this may be due to the feeling of the cloth or that they do not know what is inside the bag, therefore alternatives can be used:

- A box file or 'magic box' has been used successfully instead of the Feely Bag. The items can be seen going into the box, and the lid can be used to shield the child's view of the contents, but their hand can move inside the box without fabric surrounding it. If it encourages the child to be involved then the box can be decorated.
- Other children prefer to use a blind-fold of some sort, with the shapes on the table in front of them.



## Using familiar objects to learn how to use the Feely Bag

This is a good activity for starting to learn about the Feely Bag, or if your child is having difficulty identifying the shapes in the Feely Bag and none of the previous suggestions have helped.

- Pick two familiar and differently shaped objects, e.g. a hairbrush and a ball. Talk about what is going into the bag, allowing your child to feel the items before they go in, and then encourage your child to talk about what they can feel in the bag. You can try asking them to name the item they have found before taking it out of the bag or ask them to find a certain item. To start with it may help to have a double or picture of each item to remind your child of what was put into the bag and match the items.



- When you think they are ready, try asking them to find one of the items in the bag without using the duplicate object/picture.



- Once your child can succeed with familiar objects start to introduce Numicon shapes. Start by putting one Numicon shape and a familiar object, or two Numicon shapes that are very different (e.g. the 1 and the 10) into the bag, and repeatedly take the shape out of the bag, talk about it and find on the Numicon numberline and put it back. It may be worth having another 1 and 10 shape on the table to refer to and remind your child which possibilities are in the bag. Gradually add some other shapes, but still keep to a few at a time.



- This approach was used successfully with a 7 year old with Down syndrome who then went on to enjoy using the Feely Bag.
- Alexa Lander has used a similar approach with her child and an article describing her approach is published in *Down Syndrome News and Update*.

## Using the Feely Bag with Numicon activities

Once your child is confident in using the Feely Bag it can then be used with any of the Numicon activities. In this case it is being used more as a container than as a way of visualising the shapes.

- Place the required shapes for an activity in the bag. Your child can then select a random shape, pull it out of the bag, name it (if they are able to), and use in whatever activity is taking place.

## Advanced uses of the Feely Bag

Many of the Numicon activity cards make use of the Feely Bag by needing the child to select a particular shape from the bag or to visualise the pattern (e.g. Activity 6 – Remember the Pattern – Challenge). These are considered more advanced activities, as they require confident use of the Feely Bag and visualisation of the shapes. Therefore it is important that your child has spent some time engaging with the Feely Bag activities as described here before combining with a specific Numicon activity.

Some teaching assistants also used correctly identifying shapes in the Feely Bag as a way of winning a turn at a game that just needs a 'go'; for example you each have to identify a shape in the Feely Bag before you can add to your own base board in a race to see who can complete it first, or to make a line of the 1-10 shapes (Activity 7 – Jumbled Shapes) each.

## Number skills not covered in the Numicon activities

The Numicon activities themselves do not cover all number related activities that are important to address at this stage of number development, e.g. learning to say the number words in the correct order, familiarity with numerals and counting objects. The system suggests that all children should practise counting everyday, and many informal number activities we do with our children contribute to learning these skills.

However, when working with a child with Down syndrome it may be that some of these skills need to be targeted more directly. There are lots of ways to do this, some are described in the following section and more can be found in the *Down Syndrome Issues and Information* books and other recommended books in the additional reading list at the end of this guidebook. However, there are plenty of opportunities within the Numicon activities to work on these skills, and examples that have been tried and tested with children with Down syndrome are included in the adaptations section.

## Count word sequence production and reading numerals

Count word sequence production means the skill of being able to say a string of number words in the correct order, for example saying "1, 2, 3, 4, 5, 6, 7, 8, 9, 10". Count word production refers to the skill of being able to say individual count words, for example "I am 5".

Almost all children start off producing sequences that are incorrect (e.g. "1, 3, 4, 7") and then gradually learn the correct sequence of numbers. Once children have learnt a section of the count word sequence for a while they can only usually say the words as a whole string, without being able to say the count words individually, so they always have to start from 1 to count rather than being able to start at any number and count on (e.g. if need to count on from 3 they have to count "1, 2, 3, 4, 5..." rather than "3, 4, 5..."). At this point the words have very little meaning and saying them is just a fun game to take part in. Gradually with practice they are able to say the count words individually and attach meaning to the words.

Once children have learnt the count word sequence it can be used for many numeracy tasks – counting objects is one of these – but knowledge of the count word sequence is important for a whole range of number tasks. Therefore it is important that children get to a stage of knowing automatically which

number comes after another (e.g. “what comes after 4?” – “5”) and later it is useful to know what number comes before another, that is counting backwards, so that they do not have to think about this when performing calculations.

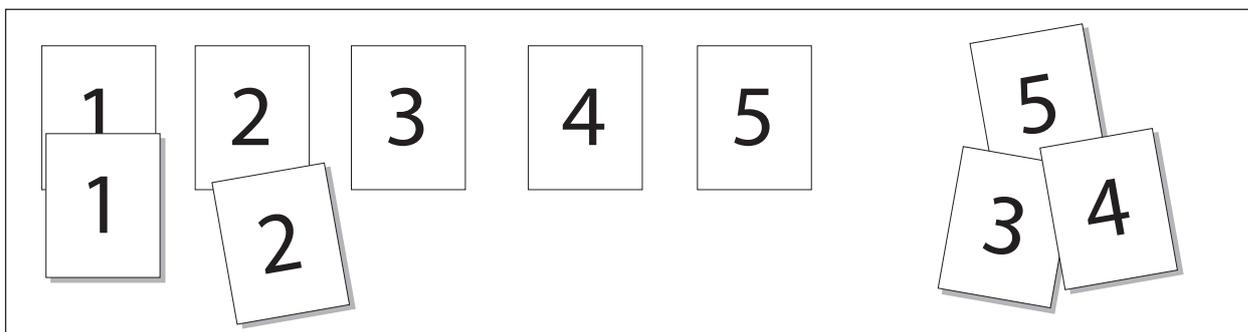
Producing the count words in the correct order is a skill that needs to be learnt up to 20 by rote – past 20 children can start to learn about the pattern of numbers and place value to generate any number, though for many children it is worth continuing to practise saying the count sequence past 20 by rote as well.

For children with Down syndrome learning the count words sequence can be a difficult task, and this is not surprising given their difficulties in language and short-term memory skills, therefore it is recommended that they are given plenty of opportunity to practise this skill.

- For children with Down syndrome it is recommended that this learning is supported by the use of a number line. This can be a simple row of numbers from 1-10 made by writing out the numbers on a strip of paper (either by hand or on a computer), see the illustration for an example. Commercially available numberlines can also be used, and a range of these can be seen in the photo on pages 6-7. They usually have a horizontal line divided by equally spaced marks on which the numbers are placed. The Numicon numberlines also have representations of the Numicon shapes on them, and while they are very useful later, it is recommended that when learning the count word sequence a more simple numberline is used. For example:

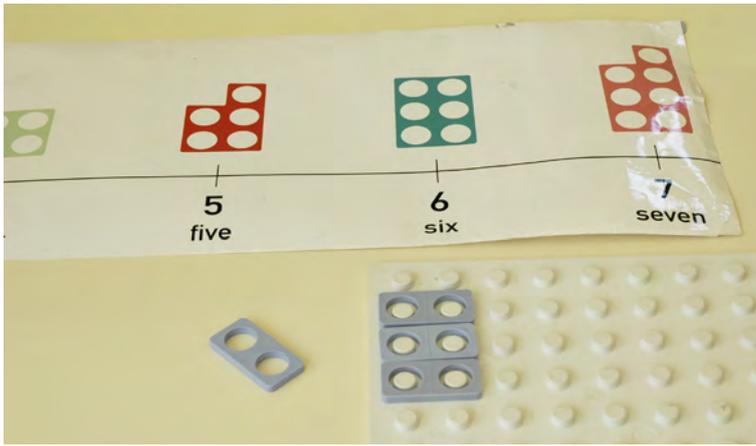


- To start with it is suggested that you work on learning the sequence from 1-10, then 1-20, and then from 1-100 using a numberline or number square. The count word sequence from 1 to 10 can also be practised with the Numicon shapes – placing them in order and counting along, or when counting any set of objects.
- Matching numerals can help in learning to name them and can be kept simple by matching pairs of cards with numerals written on them, or make more interesting by matching cards to a number line written on a picture of a caterpillar or crocodile for example.



Children often enjoy using signs for numbers (e.g. holding up their fingers to represent the numbers), and may use them more often if productive speech is difficult. It also provides another way of experiencing numbers, so can be added into activities wherever appropriate.

Learning to count in 2s, 5s and 10s, etc. is also useful to learn. Using numberlines with the sequence marked can help with this. The Numicon shapes are also well suited to supporting this. For example using a group of 2 shapes, place one at a time on the base board and count in 2s. Each time a 2 is put down the child (if familiar with the Numicon materials) can see the shape made, e.g. 2, 4, 6, 8.



Counting backwards should also be practised, once forward counting has become established, and this will become particularly useful when starting to work on subtraction.

Writing the numerals in order can also help to practise sequences – filling a blank 100 square with children taking turns is one way of doing this.

Naming numerals out of sequence also needs to be practised and “Bingo” or “Lotto” is a fun way of doing this. A

variation on this is that the child names the numerals on the cards and if they are correct they ‘win’ the card, if they are incorrect they ‘lose’ that card – with a winning and losing box if that helps.

Counting songs provide good, fun practice: e.g. 10 green bottles, 5 little monkeys jumping on the bed and 5 fat sausages provide backward counting experience. They also help the children to generalise their number knowledge and make connections with the real world. Use Numicon shapes, a number-line, pictures (e.g. a paper frying pan and sausages) or other materials (e.g. empty green plastic bottles) to support. One teaching assistant used a felt board with the numbers 1-5 stuck on it and pictures of monkeys with Velcro on the back to support the song ‘5 little monkeys’ arranged in the Numicon pattern; as each monkey jumps off the bed in the song, one monkey is removed from the board.

## Object counting

Once a section of the count word sequence has been learnt, then counting objects is not usually a difficult skill for children with Down syndrome to achieve. Often all that is needed is repeated practice in counting sets of objects.

You may find it useful to review the 5 principles involved in counting objects (Gelman and Gallistel, 1978), and for more details on how to work on each of these aspects of these please see the *Down Syndrome Issues and Information* Number books. Briefly the 5 aspects of object counting are:

- 1-1 correspondence – applying one count word to each item
- Stable order principle – always apply the count words in the same sequence
- Cardinal principle – that the last number said when counting represents the quantity of the set just counted
- Order-irrelevance principle – items in the set can be counted in any order
- Abstraction principle – knowing that anything can be counted

## Language

For many children with Down syndrome their productive language skills are delayed compared to their comprehension of language, so the Numicon materials allow the children to express their thinking about number easily and clearly. Errors in children’s thinking are often identified when they manipulate the shapes.

Whilst the Numicon system is a primarily visual support it is important to consider the language side of the activities, and use those activities as an opportunity to develop the language of number. Number and maths work contains many specific terms. It is important to make sure that vocabulary is understood by the child, and if not then the Numicon activities can be used to develop this understanding.

The language panels on each Numicon activity card can be used to check which vocabulary may need to be understood by the child to fully understand the skill being taught. However, the list on these cards contain a wide range of vocabulary and it may be worth selecting a smaller group of words to target first, rather than trying to tackle the whole list in one go. Whole word reading methods can be used to support the acquisition of the words into the child's spoken vocabulary (see the *Down Syndrome Issues and Information* books on reading for guidance).

The materials can also produce a stimulus for the children to talk about their observations on number, for example one 9 year old who had limited productive speech picked up a 9 shape and said that it was 'heavier'.

It is important to encourage the children to talk about what they have done as far as they are able to, and many children are able to gradually extend what they can say about the activities as they are practising (e.g. from saying "3, 7, 10" to "3 add 7 equals 10" when working on Activity 27 – Block of Flats).

If your child's comprehension and production of language benefits from the use of signing you may be interested to know that Makaton is developing specific signs for number and maths concepts.

## Using number words to label Numicon shapes

The first set of Numicon activities is designed to help children become familiar with the Numicon patterns and shapes, and to be able to put them in order, and these activities can be completed without referring to the shapes by their number names. Children may name them by their colours or talk about needing a bigger or smaller shape, or move them without naming them at all. Later, there are specific activities that make the connection between the number names (that the children will have been learning by counting objects, using numberlines, etc.) and the shapes (e.g. Activities 11, 13 and 14). The early activities encourage children to develop clear mental representations of the patterns, how they fit together and the relationships between them, before needing to learn their number names. During the early activities some children do realise that the shapes can be called by their number names and will start using them, however some do not, so the activities that make the link are important for them.

For children with Down syndrome it has been suggested that they may benefit from making the link between the number names and the shapes straight away, as they usually take longer to make the links and this will give them maximum possible practice in using the shapes to learn about numbers. However, this may mean that the children give less attention to the patterns as they are making sense of linking the shape and number name together, which could impact on their use of the patterns with later activities (e.g. using the Numicon shapes to do arithmetic). At the moment there is no clear evidence as to which path is more advantageous for the child with Down syndrome.

I would suggest the following:

- Where possible follow through the sequence of activities as they are set out to make sure your child does gain extensive experience with the Numicon shapes and patterns
- Follow your child's lead and if they make the connection between the shapes and number then go ahead and use in that way
- If your natural style means that you use the number names then do so to prevent the interaction from becoming awkward.

## Demonstrator making mistakes

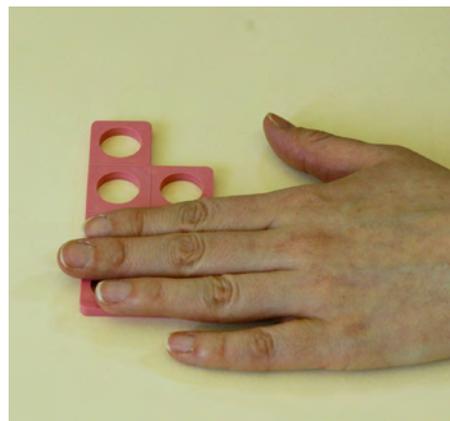
Some children enjoy pointing out when adults have made mistakes, and this can be a strategy to make an activity more fun and maintain the child's motivation in the task.

However, this technique needs to be used with some caution and should only be used when you are absolutely certain that the child understands what to do on the task and knows the correct answer, and can recognise that you have made a mistake or are being silly.

## Confusions with similar looking shapes

When learning to apply the number names to the shapes the children often find it difficult to differentiate between the 5 and 7, 7 and 9, 6 and 8, and the 8 and 10 shapes. If this is the case with your child as well as drawing attention to the colour of the shapes, it may be worth spending some time working on activities where these shapes are compared. One activity would be to cover the board as far as possible with 7 and 9 shapes.

Some children have found it useful to check the shape by covering one section and discussing how the shape is made up – e.g. a 7 is made up of a 4 and a 3, whereas a 9 is made up of a 4 and a 5. Then cover the '4' on the 7 or 9 shapes and see if you have 3 or 5 left, and so identify if you have a 7 or 9 shape (see illustration). Other children have been helped by asking them if they can see the 6 hiding in the 7, or that 9 is nearly 10.



## Difficulties in manipulating shapes

When engaged in activities that do not use the white base board, some children may find it difficult to arrange the shapes on a slippery table, and may benefit from using a magnetic board or some sort of gripping surface (e.g. felt or non-slip fabric such as used on boats). This will help to prevent items from being accidentally knocked away from where they have been placed. One teaching assistant covered a board with felt and stuck Velcro to the back of Numicon shapes and other objects used for counting (e.g. buttons), and this worked very well.

## Avoid counting the holes in the shapes

Where children can already count it may be the case that they automatically count the holes in the shapes rather than starting to use a number name to label the whole shape. This is likely to be a more persistent strategy for children with Down syndrome than their typically developing peers. Even when children are experienced with the Numicon materials when faced with a new activity, or extended activity they often revert back to counting, as it is a more well established strategy. Therefore, it is important to develop skills in using the Numicon patterns and seeing the whole shape as representing a whole number.

For us as adults who are used to using counting to solve many of the problems presented here it can be difficult to move away from using this strategy ourselves, but is very important to do this when presenting the activities.

As a guide:

- Try to remember when using the shapes themselves always refer to them by their number names and encourage your child to do the same when you know they are able to name them
- Wherever possible refer to items arranged in the Numicon patterns by the number name

- Only use counting during Numicon activities when putting the pegs or other objects into the shapes
- Count sets of objects with your child every day. Make connections by arranging them on a numberline (e.g. arranging the items in 1-1 correspondence with numerals along a tabletop numberline), then arrange the items in the Numicon patterns, and name the whole number represented
- Try to use the Numicon patterns as much as possible, as they remove the effort of counting.

## Using Numicon as part of the school curriculum

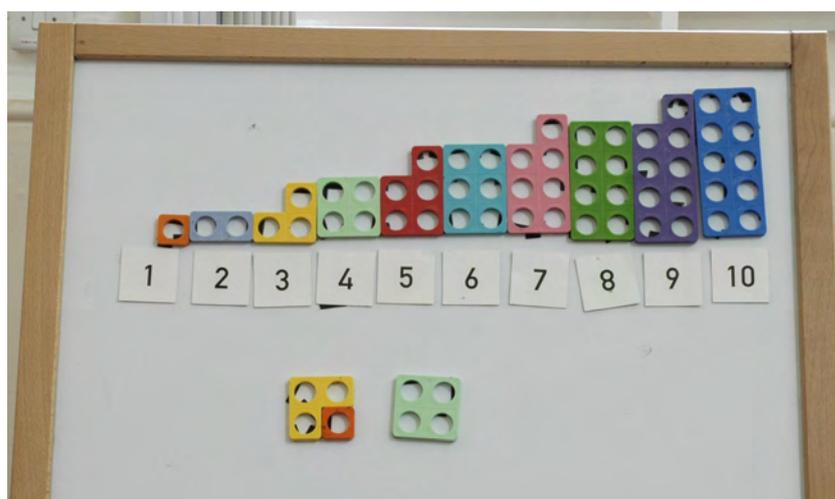
Some teaching staff have reported difficulties in balancing the need to work through the Numicon structured activities in order with the need to include the child with Down syndrome in the class lessons. An ideal situation would be for the whole class to be using the materials, however this is not always the case. Use of the Numicon system by all children in the school is most likely to occur in an infant school, as the Numicon system is designed to support the Foundation (for 3 year olds onwards) through to Year 2 (6 and 7 year olds) curriculum at present. The gap between the Numicon system and the standard junior and secondary level maths curriculum gradually widens and the possibility of difficulties in using the system to support work in the classroom is more likely, but by no means inevitable. Once the children have developed mental images of the Numicon shapes this can be used to support a wide range of arithmetical operations, including multiplication, division and fractions. We have recently heard of a creative teaching assistant working with a 14 year old with Down syndrome in a mainstream secondary school using Numicon shapes to explain percentages.

If the materials are being used in the whole class then it is useful to make use of either a magnetic board or the Numicon interactive whiteboard software to display and demonstrate the materials in whole class teaching sessions.

Different solutions to this difficulty have been found by schools and these depend on the needs of the individual children, wishes of the parents and

the philosophy of the teaching staff and school. For example, for many children with Down syndrome to access maths lessons significant differentiation needs to take place anyway, and so teaching staff are happy to use the Numicon system, seeing it as a crucial way of providing the child with Down syndrome with useful numeracy skills. Other children spend part of the lesson doing specific Numicon activities, often for 10 minutes while the class are doing mental maths activities, and then join in with the rest of the lesson, using Numicon shapes to support where they can be used. The lesson may also include any other numeracy targets that have been specified in the child's IEP that are not met by the Numicon activities or class lessons, e.g. practising the count word sequence, learning to tell the time or identifying coins and using money. Some children use Numicon every day, and some two or three times per week depending on the other targets they are working on.

Some schools have worries about the location of where the Numicon activities should take place. One concern is that using the materials or being engaged in a different activity from the rest of class might be distracting for the other children. One solution to this is that the Numicon activities are conducted outside of the classroom in a quiet area, and for some schools this then adds a dilemma between the



need for inclusion and the need to teach useful numeracy skills. However, if the majority of the student's school experience is with the rest of the children then a few minutes of individual work should not be an issue with regard to integration in the school community and may provide significant gains in the child's number skills.

For some schools this has not been an issue as they do not have areas outside the classroom to work with individual children, so the Numicon activities have been done in the classroom. In our experience, apart from some initial interest by the other children, this was not found to be a problem.

Some schools used the Numicon materials with small groups of children, which were usually made up of the child with Down syndrome plus any children that were identified as having difficulties with number. This occurred in both primary and secondary schools and in mainstream and special schools. (After taking part in these groups for a while some of the typically developing children were able to return to the regular maths lesson – using the Numicon materials seemed to have provided a breakthrough for them and enabled them to understand what numbers and maths were about.)

For further details of the experiences of schools taking part in the Portsmouth project please see the 2005 article by the author of this guide published in *Down Syndrome News and Update* (DSNU). For further ideas on adapting Numicon in creative ways we recommend reading the articles by Emma Saunders and Wendy Uttley. For further information on wider education issues please see the *Down Syndrome Issues and Information* education books. Details of these publications can be found in the reference list at the end of this book.

## Loss of skills after long school holidays

Different observations have been made on how the children get on with the activities after they have had a break over the long summer holiday. Many children need to revise the last activities they had worked on before the summer break, and while they do not always remember what to do immediately with an activity, they quickly catch up again. Some teaching staff have commented that skills in using Numicon were more quickly caught up with than other school work. Some children were able to pick up exactly where they had left off and needed little revision. This variation may be in part due to how well the skills had been learnt. One 13 year old with Down syndrome returned from the summer break with much more advanced number skills – his parents had not used Numicon with him over the holiday, so this may highlight the importance of everyday number experiences.

## Using Numicon at home

If Numicon is being used at school and you wish to support the activities at home, some families have found it best to let the school take the lead on the activities and in suggesting homework, sometimes sending home a small set of Numicon materials or sets of coloured cards with the Numicon shapes on to reinforce an activity being worked on at school, along with instructions on what to do. Alternatively you may wish to leave Numicon to school and keep number related activities to the kinds of everyday activities that you already do.

If you are using Numicon at home with your child and it is not being used in school it is important to make any links you can with what is being taught in maths lessons at school. If this is not done then children may learn school maths and Numicon as two separate systems and any benefits gained in one area may not transfer to the other, unless the child is helped to make the connections (Horner, 2002).

If you are working at home we recommend articles by Wendy Uttley that have been published in *Down Syndrome News and Update* (see reference list at the end of the book for further details). Wendy is a parent of child with Down syndrome, a maths lecturer and Coordinator of the Bradford Down Syn-



drome Support Group, and has been using Numicon with her son and other families in her area for some years. She is currently writing up more of her ideas which include lots of practical activities to extend and adapt the Numicon Foundation system. School staff would also find her ideas useful if Foundation activities are too difficult or too much all at one go for the child they are working with.

### Using Numicon as part of pre-school intervention groups

Numicon activities can be used as part of pre-school intervention groups. One example of how this can be done can be found in an article in *Down Syndrome News and Update* by Gillian Bird and Mandy Wood describing the activities used in the Early Development Groups run by The Down Syndrome Educational Trust. A version of Activity 1 – Match the Shape is used with only the 1-4 or 1-5 shapes. This activity is practised along with activities to support count word sequence production using a numberline to support and counting small sets of objects. These activities are introduced to the children when they are between 2½ and 3½ years old.



### Working with older children

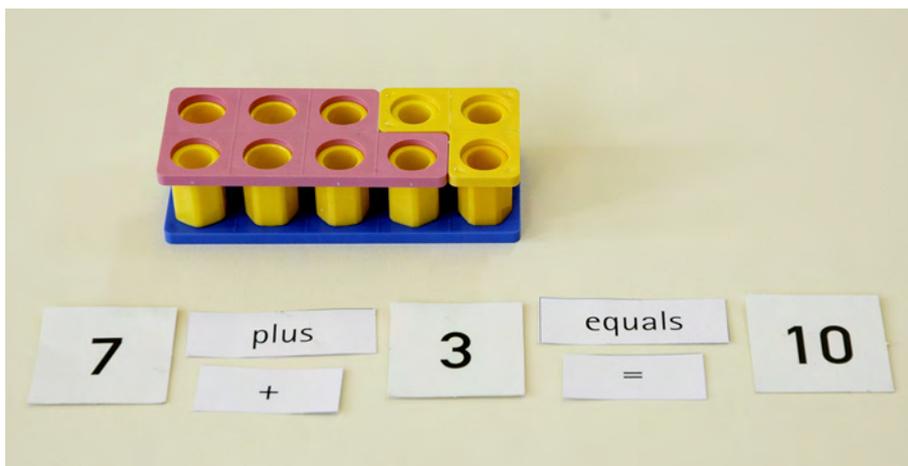
Although many children with Down syndrome will need the activities broken down into smaller steps, older children or those who have good numeracy skills already may need a different approach to using the materials. They may need something else to motivate them to take part in the early activities which they may perceive to be too easy. Using the 'Feely Bag' and/or making the activity into some sort of game with points can help.

Older children will often be able to pick up the activities quickly and so may need a greater range of variation on the standard activities in order to prevent boredom and get enough practice to achieve the learning goals. The learning goal or aim of each activity is clearly listed at the top of each Activity Card,

so it is worth keeping this in mind when adapting or varying an activity. For example, Activities 3 to 5 all have the same aim: 'For children to distinguish and recognize the patterns of the shapes'. Therefore, any activity that works toward this goal would be a useful variation, e.g. using the Numicon story cards and matching the shapes to the cards, or creating patterns with other objects.

Repeating the activities with materials that are of particular interest to the child, creating stories and connecting with their other maths work and everyday life experiences are ways of adding variation, and are also important for helping to generalise the skills learnt while using Numicon. Once they have learnt the shapes, which is the main aim of the first 23 Numicon activities, they will be able to use them to support a wide range of the maths curriculum.

For many children with Down syndrome the materials are likely to provide a useful resource for prompting the use of maths language, such as practice in saying the number names and using number vocabulary (e.g. add, subtract, take away). So even if your child is able to carry out the activities quickly you



may wish to repeat them and use this practice to extend the child's expressive language skills. For example, if they are able to put together all combinations of 2 shapes to make 10, as in Activity 12 – Build it Up, then start to talk about what they have done. First model the language you are working on and then use the materials to prompt your child to repeat, possibly with word cards alongside the Numicon materials, if appropriate. In the case of Activity 12 – Build it Up, you may wish to start with the numbers involved (e.g. "2, 8, 10") and then gradually extend to say a complete sentence (e.g. "2 add 8 equals 10" or "I've put down 2, added 8, and it equals 10").

## Foundation activities – specific adaptations and extensions

The following section outlines adaptations and extensions to the Foundation activities, all of which have been found helpful while using Numicon with children with Down syndrome. The organisation of the sections follows the structure of the Numicon system. You may find it useful to have the Foundation activity cards to hand whilst reading about the suggested adaptations.

Many children with Down syndrome are able to complete the activities as they have been described on the Numicon activity cards and they need no adaptation. Some children with Down syndrome need all activities adapted. Most children will find some activities easy to complete, whilst others will need to be adapted for them. You may not find that all adaptations are needed or are helpful for your own child, and you may find you need to create your own adaptations. We intend that this guide will help you think about the ways that the activities can be adapted, and inspire you to find your own solutions to some of the challenges you may meet in using the Numicon system with your individual child.

Other people around the world are using and writing about their experiences of using Numicon with children with a range of special needs, and these projects are providing more ideas for adaptations. Details of these projects, including contact details, can be found at the end of this book.

## Getting to know the Numicon patterns

### General extra activities

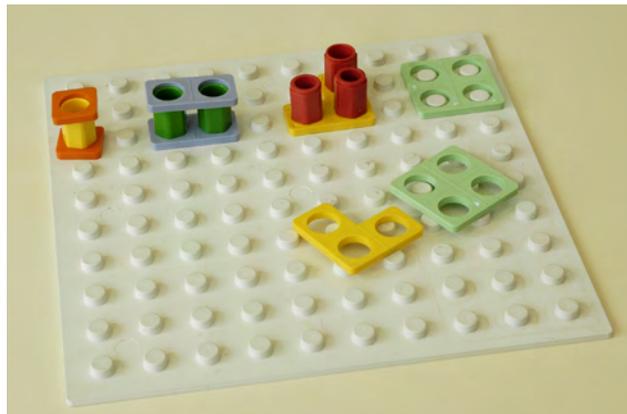
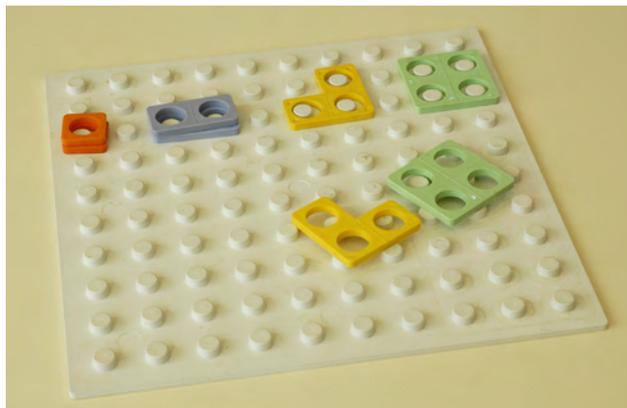
When packing away at the end of a teaching session ask the children to collect together all the 'little orange shapes', then all the 'little pale blue shapes', then the 'yellows', etc for extra experience of matching shapes together, talking about colour, etc.

If you have access to a colour photocopier or scanner and colour printer, make a set of cards with the Numicon shapes on them (the shapes themselves photocopy/scan well). Some children have enjoyed playing different games with cards like these e.g. snap or pairs memory games. This can also be a useful way of schools giving a homework activity involving the shapes.

### Activity 1 – Match the Shapes

- When first starting to use Numicon as well as using Activity 1 – Match the Shapes, it has been found useful to introduce Activity 2 – Cover the Board. This helps to make the Numicon teaching session more varied, and keeps the session fun as Cover the Board is a less structured activity than Match the Shapes.
- To begin with, make the task simpler by reducing the number of shapes you are working with, e.g. 1-4. Make sure that the child only has those items to start with and is not trying to locate them from a box of lots of shapes. When your child can match 1-4 accurately, then add 1 or 2 more shapes. Continue in this way, gradually extending the range of shapes until your child is able to match the shapes from 1-10.
- Some children are able to complete this activity using 1-10 shapes on their first attempt.
- The Activity Card suggests matching to the number line as a challenge activity, however you may find that your child with Down syndrome finds this easier to complete than matching to the model set of shapes, and this was the case for several 5 year olds with Down syndrome we observed. In a teaching session one 5 year old pointed to the 2 shape and number on the Numberline, then found the plastic shape, said “2” and held up 2 fingers (a good example of building up a ‘concept image’ of 2; for more details on concept image see the Numicon teacher’s books). You may find this activity works better with the numberline flat on the table, so the child can put the shapes down onto the matching image, rather than holding up to the wall.
- Some children may enjoy matching two or more of each shape on top of one another, e.g. to make a stack of 1s, 2s, 3s, etc. This can be done either with or without pegs between the shapes (see illustration over).

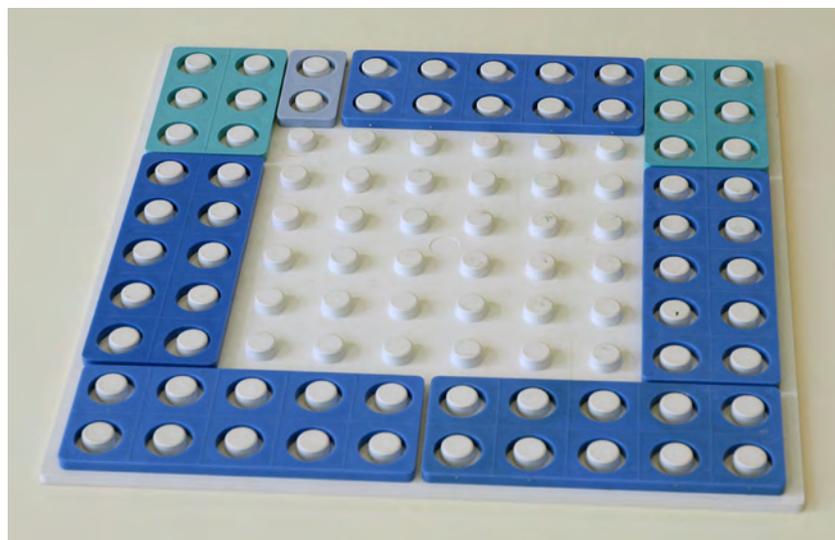




- This is a useful activity to start any Numicon session with, to use as a marker that a Numicon work session is about to begin, to refresh the child's memory and to consolidate learning of the order of the shapes.

## Activity 2 – Cover the Board

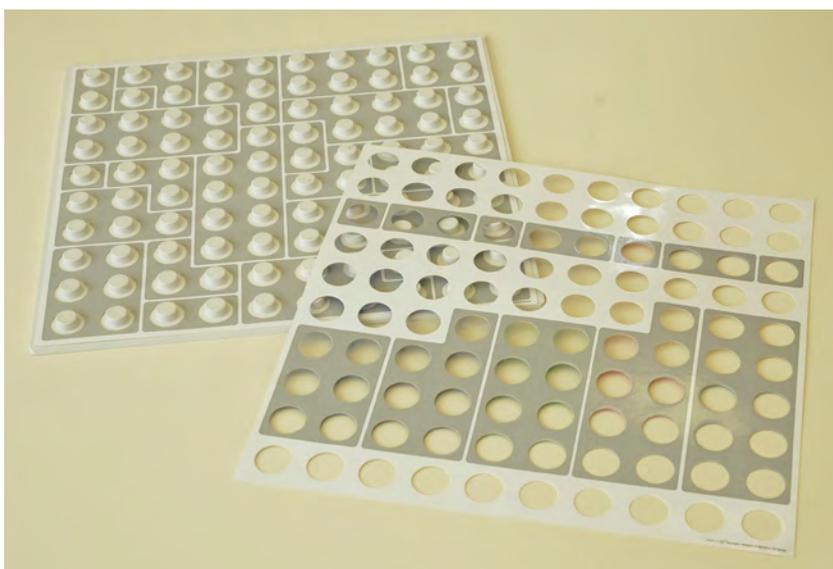
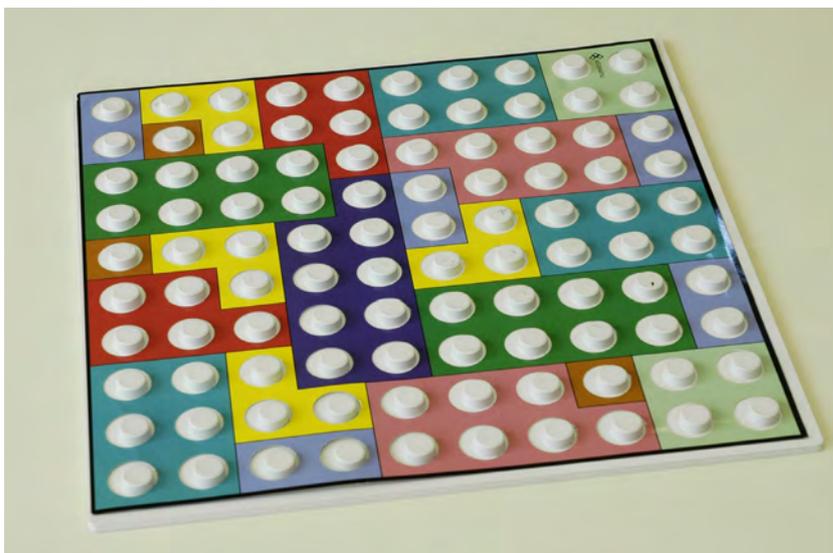
- Although this is presented as the second activity we would recommend using it first, as it fits nicely into the play activities suggested in the system to start with.
- One of the key ideas behind this activity is that the child will start to see patterns and know that a certain shape will fit into a space. The grey overlays focus the child on seeing the pattern without needing the colour as a support.



- As with all activities you can demonstrate the activity first – in this case you can have a filled board ready to show the child.
- Do lots of turntaking and use this to set up situations so your child sees a particular pattern that needs to be filled.
- Talk about what you and your child are doing.
- Demonstrate strategies that they can use – e.g. start putting shapes down from one edge, and working across with shapes right next to each other rather than starting in the middle and adding

shapes randomly across the board.

- Presenting a plain board can be overwhelming to the child. Reduce the amount of white area by putting a border round the edge using shapes. Other children have been helped by using the overlays, where they can start with a matching activity. I would recommend using the completely full coloured overlay to start with (matching will be mainly guided by colour rather than by pattern at first), then the 'puzzle' overlays, and then grey overlays (where children have to focus on pattern without the support of colour). This may not apply to all children as some find it easier to add shapes to a plain board rather than having to match shapes precisely onto the overlays – this was the case with one 5 year old with Down syndrome we observed.
- The activity card suggests showing a filled board, emptying the board and then giving it to the child to complete with those shapes only – but this is likely to really only be considered as a challenge activity for children with Down syndrome, as it is more difficult to complete the board with limited shapes than having unlimited shapes to choose from.
- To encourage children to move on from using the overlays to using the plain board, demonstrate what needs to be done and they will often join in.
- Once the child has got the rough idea of what to do, it can be worth limiting the number of 1 and 2 shapes available to the child, so that they need to start developing a strategy for placing the larger



shapes on the board in an organised way. They can then fill in the small gaps left at the end – rather than putting small shapes on first and creating blank spaces that cannot be filled, which can make the activity frustrating.

## More advanced uses of Cover the Board

- If your child enjoys this activity then we would recommend continuing to use it, even when they have moved on to other activities. This is often a good reward activity for using at the end of a teaching session. It gives the child an opportunity to play with the shapes in an unstructured way, consolidating their learning and lets them explore the materials further. Your child continues to learn – and just thinks they are having fun. With the child happily engaged with this activity that they can complete alone, then this is a good opportunity for making notes on the activities completed that day if you wish to do so.

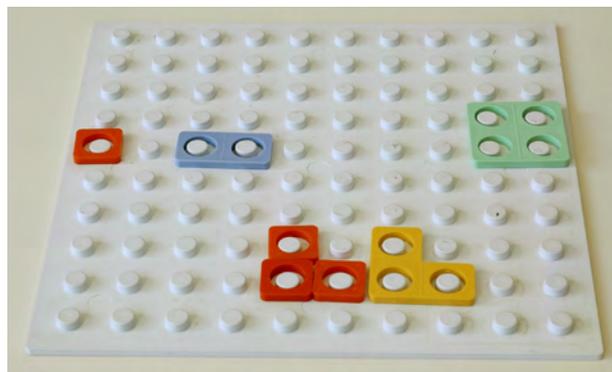
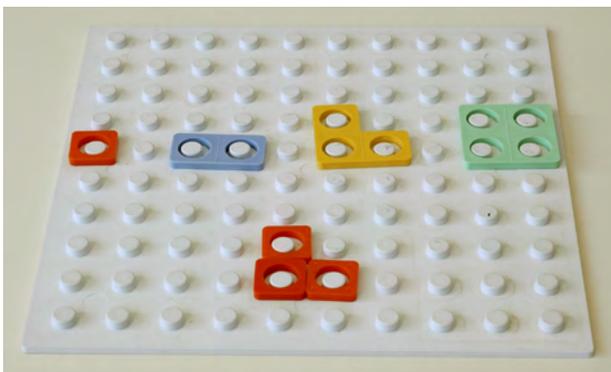


- Manipulate the shapes available for the child to choose from if they need particular practice in identifying certain shapes. For example, if they need further practice in differentiating between the 7 and 9 shapes.
- Explore what happens if only the 10 shapes are available!
- Once they have become very competent at filling the board with unlimited shapes try filling a base board with shapes, emptying the board and then ask the child to complete with those shapes only, as is suggested on the Activity Card as a challenge.
- Another challenge that older children enjoy is to complete the board as quickly as possible and to keep a record of how long they take each time.
- The activity can be used to explore other numerical concepts such as shape and symmetry, by using the Numicon shapes to make squares, rectangles, etc. or by arranging them in symmetrical patterns on the base board.
- Cover the board can also be used in a more structured way by using the overlays to support later activities, such as learning 'number facts'.

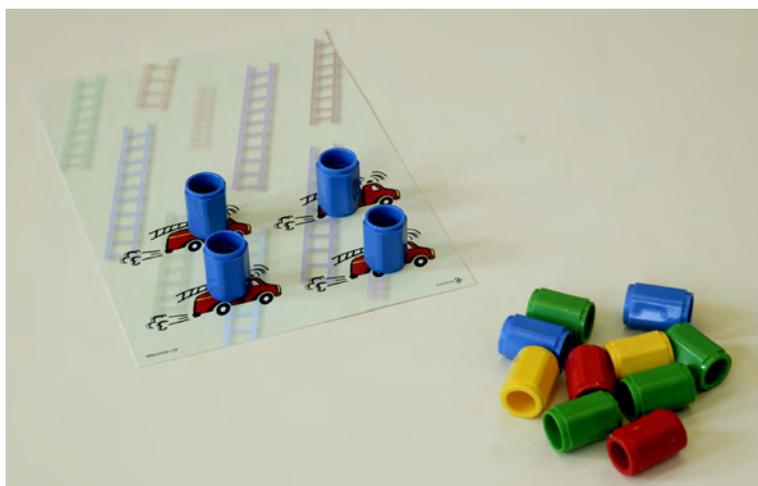


### Activity 3 – Find the Shape

- Some children find making the patterns with the pegs difficult when it is their turn, so it is important to demonstrate the activity clearly. If this is the case, it may be worth trying Activity 4 first in order to develop the skills of laying out the items in the patterns.
- One 9 year old found this activity difficult so his teaching assistant laid out the patterns using sets of 1 shapes rather than using the pegs. The next time they tried the activity he was then able to succeed on the activity using pegs.



- A variation on Activity 11 (Fill the holes) can also be used here if your child is having difficulty making the patterns – pick a shape and add the pegs (no need to count them) and then find another matching shape to fit on top. These often end up being called ‘sandwiches’!
- As is suggested for Activity 5, the patterns can also be made with other materials (e.g. buttons or toy animals) if you need to add some variety to the task, and keep your child’s interest.
- If you have a set of the Numicon story cards then they can be used in an extension activity, by matching the shapes to the cards. One 9 year old had difficulty with Activity 3 so they added pegs to the pictures (as is done in Activity 25 Wrapping paper), and then added them to the correct shape, to help make the connection between the pattern on the card and the shape.
- To extend the activity further for a 9 year old who already had a good range of number experience, he and his teacher discussed how many to add each time to get to a greater number.



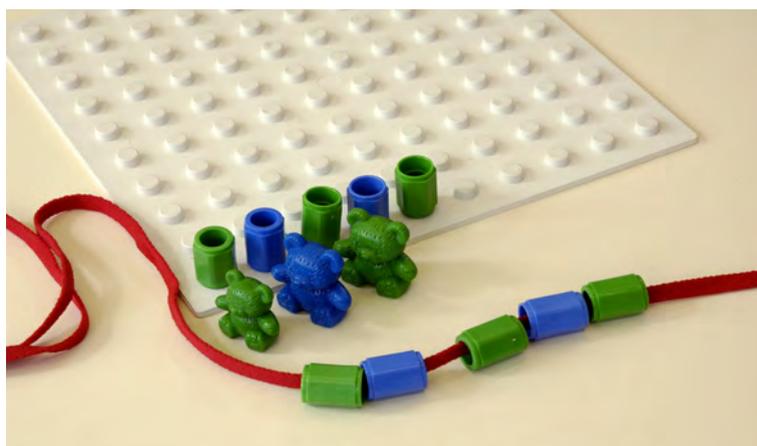
## Activity 4 – Copying

- As the spatial skills (e.g. recognising a pattern and being able to reproduce it) needed for this activity are quite complex, some children find this activity difficult. They often lay the pegs out in a row to start with rather than in the pattern or create a larger group of pegs than needed.
- If you find this to be the case then focus on activities using the shapes for a while longer, and then return to this activity when you feel your child is more familiar with the overall pattern represented by the shapes. Some children may benefit from spending some time adding the pegs to a shape placed flat on the base board (with the adult or other child having modelled this first), before moving on to copying the peg shapes.

- You may also find it useful to spend some time making patterns with other materials, and this can be as simple as threading beads in patterns (e.g. red, blue, red, blue, etc.) or making patterns to copy with the Numicon pegs on a board. Gradually make the patterns more complex working towards copying the Numicon shapes.



- When you do work on copying the peg shapes, focus on demonstrating the activity clearly, prompt your child to keep checking the pattern of the model as they make their own pattern, and use the shapes to check that the pattern made with the pegs is the same, both during and at the end of making the pattern.



- One 11 year old arranged the pegs in a row for several months whenever they tried this activity. They usually worked on the same base board to do this. Then in one session when this happened the teaching assistant gave her a board of her own, created a 3 and a 5 shape and this time the child copied both patterns correctly. It is not completely clear why having a board each would make such a big difference, but it may be worth trying in this and other activities to give a different perspective on the activity.

- To encourage engagement in this activity one teaching assistant successfully used a version of the ‘Simon says’ game with a 9 year old with Down syndrome, who was initially not interested in the standard activity. In the ‘Simon Says’ game one person is chosen to be "Simon" and the others have to do whatever action Simon tells them to do, usually using the phrase “Simon says ..(e.g. touch your nose)...”. To use as part of the Copying Numicon activity you might say “Simon says copy this shape” and show the shape you want them to copy. Take turns at being ‘Simon’.

- One 5 year old tended to play with the pegs rather than using them to complete the task, and this was solved simply by the child and his teaching assistant both having a Feely Bag with pegs in them, which stopped him playing with them until needed. It was also thought to motivate him to take part in the task as they were both ‘the same’. On one occasion he also started the activity by adding

pegs to the previous shape he had already made, rather than making a completely new pattern – very efficient, but not quite what the teaching assistant wanted! The next day he spontaneously made separate shapes.

### Activity 5 – Make a Pattern

- This activity can be difficult for some children, so it is important that they are able to complete Activities 3 and 4 before moving on to this one. It may still take a few sessions with smaller shapes to get the idea of what to do, and some children need repeated practice with the larger shapes that are easily confused (e.g. 7/9 and 8/10).
- As suggested on the activity card as a ‘Challenge’ it can be repeated using other objects that the child enjoys working with e.g. plastic animals, Compare Bears, Unifix, Multilink, buttons. It can be made into a much larger activity involving gross motor skills, by working in a large space on the floor (e.g. school hall or playground) and using larger items such as P.E. games equipment (e.g. beanbags, quoits or markers).
- Another extension is for your child to make their own patterns using drawings, self-inking stampers or stickers. These can be made on individual cards or in a scrapbook (with one number per page). Once they are working with numerals or number words these can be added to the pages, and the scrapbook can be added to when different resources are found to add to it.



### Activity 6 – Remember the Pattern

- Limitations in short-term memory may mean that this is a difficult activity for your child to complete, so they may need to be reminded of the shape they are aiming at throughout the activity, until they are more confident with the shapes and the specific activity.
- First use colour to prompt visualisation of the shape, and if that does not help then show the child the shape again.
- It is important to encouraging visualisation of the shape, to help develop mental images of the shapes.

## Putting the shapes in order

### Activity 7 – Jumbled Shapes

- Before starting this activity it is important to make sure that your child is able to complete Activity 1 reliably. It may be worth repeating Activity 1 once or twice if you have not done it for some time to check this and to remind your child what needs to be done before starting on Activity 7.
- It may be useful to have a large wall Numicon numberline in front of the child as they complete the activity, so they can refer to it if necessary, but later you might want to try the activity without any support to check that it has been well learnt.
- To extend the activity further, add in the use of the Feely Bag.

## Activities 8/9/10 – Fill the Gap / Which One is Missing? / Swaps

- The children often enjoy these activities, they enjoy covering their eyes and taking their turn at ‘tricking’ someone else!
- Some children need to count along the row of shapes to identify which shape is missing/has been moved to start with, and to check that they have completed the sequence correctly. Once they have the idea of what they need to do, they can be encouraged to do the activity without counting along, i.e. so that they are using the shape before/after the gap to see what is missing, and are focusing on the patterns.
- Some children get confused when switching between these three activities as they are so similar, so a clear demonstration is really important to clue the child into which task you are working with.
- The challenge activity asks if the child can describe which shapes to move and where to place them. If they describe what they are doing that is great but for many children with Down syndrome limited productive language skills may mean they are unable to complete the challenge. They often understand the activities but cannot yet put this into words. Do not stop working through the next activities because of this as it need not hold them up from working on the ‘visual’ activities. They can continue to work on productive language skills whichever activity they are working on, and then gradually be able to talk more about what they are doing. You may wish to go back and practise earlier activities in order to practise talking about what is being done.
- Older children may be able to cope with having more than two shapes swapped around. One 9 year old was able to do ‘Swaps’ after his teaching assistant had swapped five shapes around.

## Give the shapes their number names

### General activities

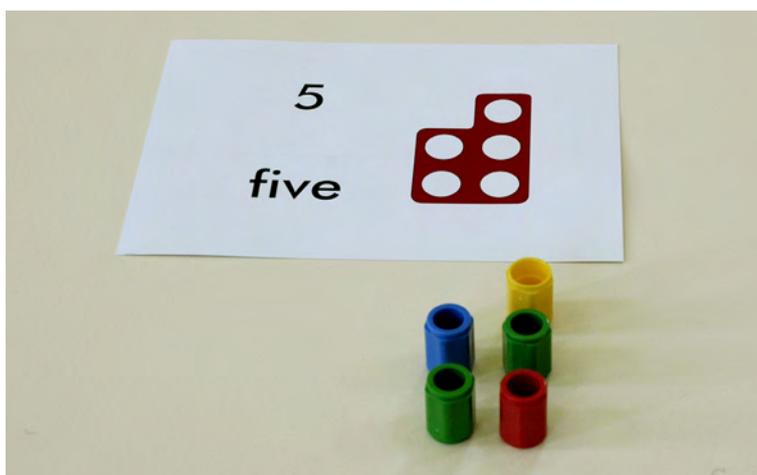
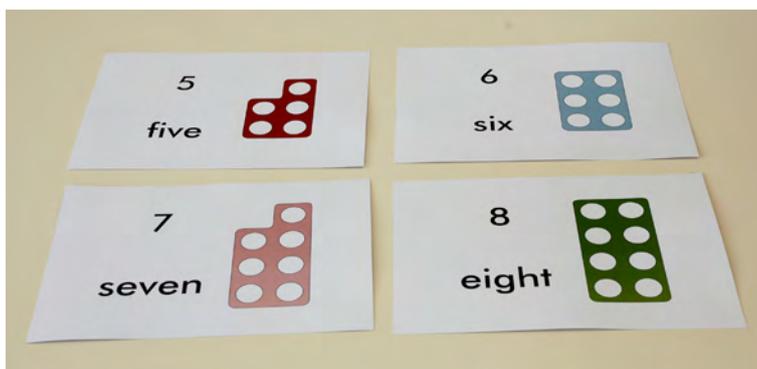
- Once you have started to connect the number names with the shapes, whenever you get the opportunity while handling the materials ask the child for certain shapes (e.g. “Can you give me the 3?”) or ask them to name them (when they can). This can be when you are taking materials out, putting the shapes on the board, taking them off the board, packing them away, or make it a quick specific game by taking them out of a Feely Bag. Either one of you can be handling the shapes. Many children will be able to show that they understand number names (by selecting the number or Numicon shape you have asked for) and can give ‘3’ or ‘4’ objects before they can say number names themselves.
- Ask them to collect together all the 1s, then all the 2s, then the 3s, etc. to pack away.
- To support development of the connection between Numicon patterns and number names, one teaching assistant working with a 6 year old produced some A5 cards with the Numicon image on them, plus the numeral and the number word. The cards were used in a variety of ways including adapted versions of Activities 14, 15, 16 and 20. The cards are quite large so these activities were usually done on the floor. To start the teaching assistant put out the cards in order from 1-10 and then added a set of plastic Numicon shapes underneath but mixed up so the child had to re-order the shapes. In another teaching session they laid out the cards and the child created the corresponding Numicon pattern with Compare Bears or plastic animals under the cards. Next the child started ordering the cards himself, needing help to begin with, then gradually being able to order them himself. Once the child was able to complete these activities with the large cards they moved on to just using numeral cards, as described in Activities 14, 15, 16 and 20.
- To adapt this activity without needing to make additional cards, a version of this can be completed with the materials already in the Numicon kit. Lay out the numeral cards, and Numicon shapes if needed, and then create sets of items (e.g. cars, dinosaurs, etc) in the Numicon patterns with each

number – starting with 1-4 and gradually extending up to 10.

- One 12 year old we worked with was good at and enjoyed French, so sometimes would name the Numicon shapes using French number words rather than English!
- Use the Numicon story cards to practise naming the patterns – they can be held up and the pattern named quickly.

### Activity 11– Fill the Holes

- A pre-requisite for success on this task is the ability to count sets of objects.
- If children are able to count 10 objects then they will be able to try the activity as described on the activity card.
- If your child is able to count smaller sets of items then they will be able work with shapes up to the maximum they are able to count. In addition, the activity can be used to extend their counting skills up to counting 10 items, along with counting sets of other objects and counting along a numberline.
- If your child is unable to physically manipulate the pegs and push them into the shapes then you can do this aspect of the task while the child counts the pegs as you add them. Alternatively you can cut egg boxes into the Numicon shapes and your child can count other objects into the sections of the egg boxes, and this is a useful variation on the activity for all children. You may be able to find some egg boxes that are the appropriate colour (e.g. make a 3 from a yellow box) however you may wish to paint plain egg boxes to get the correct



colour shapes. Grey egg boxes cut into the patterns are useful for moving away from a reliance on colour.

- The children become skilled in manipulating the pegs through practising using them, so it is helpful to give the children some 'free-play' time with the pegs and shapes to give them this practice without pressure to succeed on a particular task.
- To extend the activity further ask your child to find the shape on the Numicon numberline and read the numeral underneath.

## Activity 12 – Build it Up

- This is an activity that the materials lend themselves to doing and children will often have already started to build up towers of shapes and pegs as part of their play activities.
- They often enjoy referring to what they are making as 'sandwiches' or 'cakes' with pegs as candles on top, and this activity can be made more fun by talking about the fillings or flavours they are using.
- It is a fun and very useful activity that can be used both much earlier than the position in the activities suggest and for longer. Later, Activity 27 is a repetition of this activity but is used as a way of teaching number facts.
- Some children find the odd numbers more difficult than even numbers, so if this is the case focus on the even shapes and then move onto the odd ones.
- This activity can also be combined with Activity 11 – Fill the Holes, by counting the pegs as they are put on each layer of the tower – but only do this if it does not distract your child from the main goal of adding pegs and shapes, or make the activity become too lengthy.



## Activity 13 – Spin a Pattern

- A pre-requisite for this activity is being able to name or recognise numerals 1-10. To work on this, numeral matching and practising saying the number sequence using a numberline are recommended (see earlier section for suggestions).
- If your child needs practice in naming the shapes using number names this activity can be used to do this.
- For some children using the spinner, reading the number and then finding the correct shape can be too much to do all in one activity to start with. The adult or another child might need to assist with reading the number to start with.

- Some children may need their attention drawn to the arrow end of the spinner and marking it with a dot (coloured sticker or dot of paint) at the end may help them to do this. They may also need teaching how to 'read' the spinner, e.g. reading what is in the section that the pointed end of the arrow has come to rest at.
- Reducing the number of Numicon shapes available for them to choose from can help. One 6 year old was helped by having just 2 shapes available for him to choose from to begin with.
- Another simplification of this activity is to remove the aim of collecting a set of shapes, and just take turns to find a shape to match the numeral on the spinner/dice.
- One 9 year old worked with an extension to this activity, by using 2 spinners (1-5 and 6-10) and added the numbers together with help. To start with this could be done by putting the 2 shapes together and recognising the pattern made, or by mental arithmetic when your child is able to do this.

## Ordering the shapes and numerals

### Activity 14 – Give it a Number

- It is important that your child is able to complete Activity 13 or a version of it before moving on to this activity.
- Some children will be helped by having a Numicon numberline on display to refer to when first starting this activity.
- The Numicon numeral cards can be used for practising ordering the numerals from 1-10.
- As the number cards are being laid out the child can be encouraged to name the numeral or discuss if numbers are odd/even, etc. depending on what they need practice with.
- If errors are made it can sometimes help the child to do a check by counting along the shapes/ numeral cards reciting the counting sequence from 1-10.
- At a later stage some children find it useful to repeat this activity with the numbers and shapes placed in the standard pattern but starting with 10 and working across to the left down to 1, or to order the numbers and shapes in reverse order (e.g. going from 10-1 from left to right) to assist with thinking about using numbers in reverse order.
- Another extension to this for older children is to continue the numberline beyond 10 and on to 15 or 20 and beyond.

### Activity 15 – Swap the Shape, Swap the Numeral

- A teaching assistant extended this for one 9 year old first by dealing the cards face down at random under the number shapes, with the child turning over each card and putting under the correct shape, and then further extended by mixing up the number shapes so that he had to look more carefully at the shape and numeral.

## Knowing the shapes and numerals

### Activity 16/17 – Number the Shapes / Spin a Number

- If your child is not yet able to name the numerals it is still worth trying this activity, as it will be worth working on matching the numeral card visually to the shapes. The activity can then also be used to work on naming the numerals.
- If competition with other children is a motivator for your child then this activity can be conducted in pairs or a small group, with the winner being the child to complete the activity in the fastest time.

We would recommend only using this activity when they are able to complete it on their own with no time pressure.

- Another variation on this is to place the shuffled number cards under the shapes face down. The child then turns over one card, places it under the correct shape – at the same time picking up the card that is currently under that shape. That card gets turned over and placed correctly, and so on. Again this can be used in a competition situation if appropriate.

### Activity 18 – Dough Numbers

- Several children in the research study did not like playing with playdough or found it difficult to manipulate, so they found other ways of experiencing numerals – writing numbers in sand, sticking pasta shapes on card on top of outlines of numerals, using cut out strips of paper to make numerals.

### Activity 19 – Feel and Find

- Feeling for a shape in the Feely Bag is very difficult for some children, therefore if your child is not able to do this move on to Activity 20 and return to Activity 19 when you have spent some time playing with the Feely Bag in ways suggested in the general adaptation section (see pages 9 and 10).

### Activity 20/21 – Picture the Pattern

- A pre-requisite activity that needs to be completed is Activity 5 – Make a Pattern, therefore it may be worth revisiting before starting on Activity 20.
- If your child is unable to name numerals at this point then they can still make use of the activity, either by using the spinner overlay with Numicon shapes on it or by you naming the numerals. While naming the numeral, point to the numeral on the spinner, and encourage your child to do this. At the same time try working on reading numerals as a separate activity (see page 12 for ideas on how to do this).
- Start this activity with the smaller numbers and move on to the larger numbers when your child is able to do so.
- Working in front of a Numicon wall numberline will be particularly useful for this activity, so the children can refer to it when they need to. Later you may wish to try working away from the numberline to check that your child can clearly picture the patterns in their mind, and recreate them in response to the numeral.
- Choose objects that your child can easily grasp and that stay in place (e.g. avoid beads that roll around).

### Activity 22/23 – The Lost Peg / Hunt the Peg

- It can be helpful to start this activity by arranging patterns 1-4 with each arranged in one colour of pegs (e.g. 1 in blue, 2 in red, 3 in green, 4 in yellow) then as one peg is removed or moved it is easy for the child to see where it needs to go. As soon as you think your child is able to understand the task then move to using either one colour of pegs for all patterns, or a mixture of pegs.
- Some children find it helpful to start this activity with a row of corresponding shapes under the pegs, which can be removed once they understand the activity.
- Some children are able to identify where the peg has moved to in 'Hunt the peg', but are not able describe what has happened, as the language required to describe this is too complex for them to use. So to start with they can point, and then use the activity to practise language.

## Understanding place value and using patterns

### Activity 24/25 – How Many Without Counting / Wrapping Paper

- This is likely to be the first activity where your child is introduced to numbers and patterns above 10. So you may need to spend some time demonstrating how to arrange the pegs in a group of 10 and then the additional pegs in a separate pattern to one side. To support this have a Numicon numberline nearby, and find the number created by matching the appropriate shapes to the numberline.
- The challenge activity suggested for Activity 25 (estimating first) can also be used as an extension for Activity 24.
- The challenge activity under Activity 25 suggests asking the children to estimate how many pegs there are first. Some children are able to do this, however, many children with Down syndrome find this difficult – they often want to count the pegs to get it exactly right.
- One way to work on the idea that it is useful to estimate sometimes is to use a white base board and arrange a few pegs on it (as in Activity 24) and hold under the table or cover with a cloth. Then show the board to the child for a brief amount of time, and ask the child to ‘say how many there are really quickly’ – if necessary show it again. If the child is reluctant to estimate then you take a turn first. Then check the estimates by arranging the pegs in the patterns and seeing how many you actually have. If any estimates are wrong you can discuss how close they were, if appropriate for your child.
- You can record estimates made by you and the children either by selecting shapes and putting on the table, or writing them down, whichever is appropriate for your child. You can then compare your estimates with the actual number of shapes without needing to remember them.
- This estimating element to the task is important as later this becomes useful for your child to be able to think about whether an answer is possible.

### Activity 26 – Make a Story

- Every activity in the system once completed should be linked with everyday materials and Activity 26 gives ideas on how to do this, therefore this activity should be used as much as possible after each of the other activities, rather than being seen as a distinct activity that is only used once.
- It is usually a popular activity with the children, and is very important in connecting the numeracy activities with their everyday life.
- Language limitations can sometimes make this a challenging activity, but by using concrete materials, pictures and word cards to support it is a good exercise in practising language skills involving number related content.
- Examples of stories that children have made up include children getting on a bus (e.g. 5 children are on a bus, 5 more get on. How many altogether?), children in the park, children in the classroom – how many round each table (one 13 year old used models of people to represent his friends in the classroom), ducks on a pond, friends coming to tea and eating cakes.
- One 12 year old and her assistant made up a storyboard about sports day with points for different events, which they then added together for each school house.
- A 9 year old who really enjoyed this activity and her teaching assistant would take time each day to make up 2 stories each related to the maths work they had done.
- This also became a regular activity at the end of each session for one 13 year old. For example, during one lesson he chose 2 model characters (small play people) and named them Becky and Chris. They were put on one side of the base board. The teenager then said that Chris had invited Becky to tea. The teaching assistant asked him to tell us how many sausage rolls he was giving

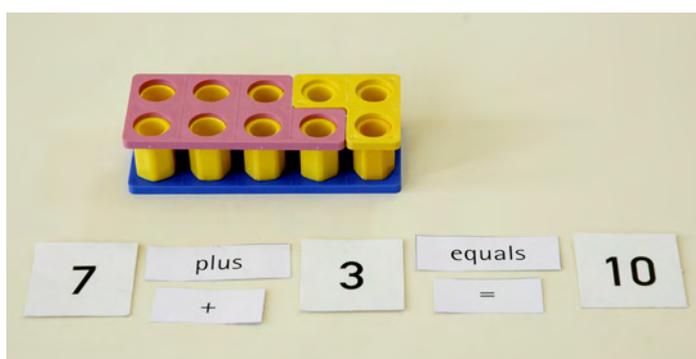
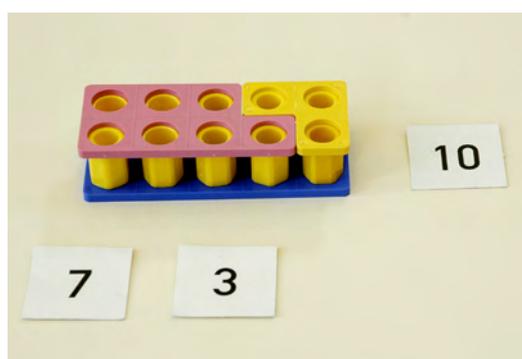
Becky. He said 10, and then added pegs in a line in front of Becky. He did not usually line up the pegs so when he stopped his teaching assistant asked if Becky had 10, he said yes. His teaching assistant then got a 10 plate and they added the pegs to the plate, and this showed they only had 8, so the teenager then added 2 more pegs. They added this onto the base board in front of Becky. He then said how many sausage rolls Chris was going to have and added that number of pegs in the Numicon pattern (4). He then added drinks and biscuits, each time adding pegs in the Numicon shapes. Each character has one colour of pegs. We then asked the teenager various questions where food is eaten or added, so he needed to add or subtract. He enjoyed creating the scene and story, and engaged in attempting to answer the questions posed.

- The same teenager and teaching assistant often discussed significant numbers when they came up in activities (e.g. 101 dalmations, his house address, his and other peoples ages), and they made lots of connections between the activities and the real world.

## Addition

It is recommended that all Activities from 1-26 are thoroughly learnt before moving onto working on addition activities.

### Activity 27 – Block of Flats



This activity is a very close extension of Activity 12 – Build it Up. This time the child is asked to find 2 shapes that fit together (whereas before they could have any number of shapes to fit on top), and is designed to start working on learning number facts. These are facts learnt about combinations of numbers that go together to make the target number, and can be instantly recalled. For example, 2+2, 1+3, and 3+1 all equal 4. Number facts to 10 are often the focus of much practice as they are very useful, as are multiplication tables later on. However, all addition and subtraction number facts up to 10 are also useful to learn. Once learnt they can be recalled immediately and used in arithmetical calculations without needing to take the time and effort to work them out.

In this task the children are also asked to talk about what they have done and this is where some children with Down syndrome may need to break the activity into smaller steps:

- Initially work on getting the idea of adding two shapes. To start with you may wish to present a limited choice for the second shape to be added if it helps your child attend to the task. Then the adult can talk about what has been done, and the child can join in where they are able.

Your child may be able to talk about how many more are needed as you add the pegs.

Gradually work towards the child saying which 2 shapes have been put together to make the larger shape on the bottom (e.g. “4 and 6 make 10”, or eventually “4 plus 6 equals 10”). To help support saying the sentences they may be helped by using numeral and word cards (or writing on a white board), before reading the whole sentence out. If necessary selection of word/

number cards or writing can be done by the teaching assistant, with the child focusing on putting the shapes together and reading the sentences.

- It may be that talking about what has been done will take some time to work through, and it will be worth moving on to Activity 28 and beyond at the same time.
- If productive speech continues to limit this activity then placing numeral cards by the side of the tower, or writing the sums on a white board may be a useful adaptation.
- The challenge on the Numicon activity card suggests finding all combinations of two shapes that make up a number – this can be supported by using overlays that represent these combinations, or just by laying out each combination flat on the table.
- One 9 year old was not always able to say the total the shapes came to unless they were taken off the tower and placed flat on the table – e.g. if putting together 2 and 2 when asked how many there were he said “2” but when placed flat on the table he said “4”.
- Having made a stack of shapes representing facts to 5, one 7 year old and her teaching assistant then took it to the computer and used it to support an activity involving finding the missing number in sums that make 5.
- After working on the activity for 5 teaching sessions over one month one 9 year old with Down syndrome was able to ‘pretend’ to build the block of flats. She would say which shape she was pretending to put on the bottom (e.g. 10), would then act out adding imaginary pegs, and then add two imaginary shapes on top, explaining which two she was putting on. This activity indicates that she has a clear mental image of the shapes and number facts to 10. She went through all the number facts to 10 independently, and was able to say each sentence correctly. She followed this up by writing out each number fact in her maths workbook.
- It should be noted that recording written sums does not get introduced in the Numicon maths system until Kit 1. The system emphasises taking time to develop numerical skills and ideas before needing to take time and effort in to converting those new ideas into written symbols, allowing all attention to be focused on the materials and the new skills being learnt. In the examples given here it was appropriate for the children as they were already writing and recording their work before starting to use the Numicon materials. However, it is important to make sure that your child is not overloaded by trying to write as well as work through activities with materials, and only start recording when they are fluent in an activity. It may be that your child is able to record some work using numeral cards, or use stickers with numbers on them to place in a workbook, but again this must only be when your child has grasped the activity with the materials.



## Activity 28 – Make that Number

- If you have not done Activity 27 (Block of Flats) and Activity 13 (Spin a Pattern) for a while you may want to repeat them as they lead to Activity 28.
- Some children may find it difficult to work towards a target number in this way, as opposed to putting two shapes together and seeing what they have made. One successful adaptation to this is for the child to find the target shape first and then to find two shapes that fit on top.
- If the spinner is distracting, you could also start off by pulling a random shape out of the Feely Bag, and then putting two other shapes on top to make the target shape.
- The next step for some children may be to put the 2 shapes to the side of the target.
- Gradually reduce the use of the target shape by repeating the same shape but with the target hidden, and encourage your child to picture the shape in their mind's eye or 'in their head'.
- If you have the base board overlays then practise with 'facts' overlays may help in putting together two shapes to make a target.
- Several children found it helpful to have the target numbers they were working with written down (written on paper or a small white board, or use a numeral card). They had experience of working with written numerals so this was a familiar strategy for them.
- If this activity is very difficult for your child you may want to try Activity 31 – One More, as some of the children find this easier than Activity 28.

## Activity 29 – Turn it Over

- To start with you may wish to reduce the range of number cards (e.g. 2-4) and shapes (e.g. two each of the 1-2 shapes) presented, gradually extending to 10.
- As in Activity 28 your child may find it useful to start by finding the target shape and placing two smaller shapes on top, when they are needing to 'target' the remaining numbers to be turned over.
- Although this activity may be difficult to start with, it is important in the Numicon teaching structure. It can reveal when the children are starting to think strategically (e.g. what they need to make the target, and what shapes do they need if only the 2 and 3 cards are left).

## Activity 30 – Feel and Make

Although this activity uses the Feely Bag to start with it is simply as a container for picking out random shapes, so this can be done even if your child is not confident about identifying shapes while in the bag.

## Activity 31/32 – One More / Spin One More

- To develop understanding of the word 'more' one 7 year old worked with a game where they used the spinner to put together two or three shapes and then find the matching shape to go on top – if the child placed a shape that was too small his assistant said 'more' and the child learnt that he needed to find a bigger shape to fit on top. They also gradually used 'less than' as well in this activity.
- Another extension activity that has been used successfully is adding threading beads one at a time to a shoelace.
- After a couple of lessons using this activity one 9 year old was able to 'draw' the additional one shape onto the other plates using her finger, to pretend to add one. In the next lesson after a few trials using the 1 shape to add, she was then able to say what the answer would be without using any materials to support. Her performance on 'adding one' did vary a little over the next few les-

sons, and this activity needed to be practised before her teaching assistant was certain she understood.

### Activity 33/35 – Doubles / Double It

- If your child enjoys the task and is working with numbers from 12-20, you may want to extend the activity to doubles of shapes from 6-10.
- In order to see that the number made is greater than 10 some children found it useful to have an extra 10 shape to place over the top. They could also then see what other shape was left (e.g. 6), and so work out which teen number they had made (e.g. 16).
- One 9 year old who had spent some time on doubles, then went on to work on halving, and working on the inverse relationship between the two operations.

### Activity 34 – Feel for the Pair

- It is important to start with just a few pairs of shapes to minimise frustration when starting this task.

## Subtraction

- Before working on subtraction you may find it useful to revise the different ways that subtraction is used and make sure you are clear about what is involved in each activity before starting to work on it with your child – these are clearly explained in the Numicon teachers books. In the Foundation stage subtraction is introduced for using to take away and for making comparisons or working out the difference.
- If your child already uses “take away” or “minus” it is not necessary to start using “chop off”, but you may find it useful as you will need to talk about *pretending* to take away something from the Numicon shape.
- Some children find it difficult to cover over the shape that is being taken away accurately, so you may find it useful to make grey or black cards in the 1-10 shapes that the children can then use to place on to represent the amount being subtracted. One easy way to make these is to using a black and white photocopier to copy one of the grey or coloured overlays, preferably onto card. Alternatively cut out the shapes from grey or black card using the actual Numicon shapes as templates so they are the correct size.



### Activity 36/37/38

#### – Chopping Off Game / Take Away a Pattern / Chop Off 1

- As was the case with addition, some children find it easier to start with taking away 1 rather than larger amounts, so if Activities 36 and 37 are difficult try Activity 38.
- While working with Activity 36 one 13 year old found it helpful to start off with even numbers and take away half – he could see that half the number was always two of the same, and made use of previous work they had done on doubles.

## Activity 39 – Pick and Take One

- This can be extended slightly by combining the activity with Activity 23 – ‘Hunt the peg’. One child in a pair closes their eyes, the other child or adult takes away a peg from the arrangement, and the first child has to identify where the peg has been taken from and then say the sum. Saying the sum can be supported by having a template on a whiteboard or paper:  $\square - 1 = \square$ , and if appropriate the child can complete the sum on the board.

## Activity 40 – Hide One – What’s Left?

- The language requirements on this task may be too much for some children with Down syndrome, so start by demonstrating and then work through the activity with the materials together as far as you can. Continue to work on other tasks and return to this one to practise the language element.

## Activity 41/42/43 – See the Difference / Compare the Spinners / Feel and Compare

- Some children have found the term ‘difference between’ difficult to understand and it may take some time to learn. Practising these activities and modelling the language will help with this.
- It is not always clear if children really understand ‘difference’ during these activities as it is obvious what pattern is left, so it would be worth testing this with other materials or by using the Challenge activities.

## Activity 44 – How Many More? How Many Less?

- Being able to make a judgement that one number is bigger or smaller than another is a prerequisite skill before starting Activity 44. This should have been worked on as part of the language during Activities 7-10, but may need to be checked before starting Activity 44.
- A Numicon numberline can be used to support making the judgement that a number is bigger or smaller than another.
- One child needed to work on ‘more than’ and practise making the judgement that one number (e.g. 9) is more or less than another (e.g. 8 or 10). They did this by writing down the sentence ‘9 is 1 more than 8’ and then gradually working through different combinations. The teaching assistant wrote out the first two sentences and then the child continued. When needed, Numicon shapes could be used to support this.
- Another way they practised this was to use the 1-10 numeral cards or 1-100 Numicon playing cards in an adaptation of the game show ‘Play your cards right’. In a small group the children dealt out the cards and then laid one down at a time each saying whether they thought the number they had put down was going to be bigger or smaller than the last; if they were right they got to keep the card, if they were wrong the other person got to keep it. The winner was the person with the most cards at the end of the game.

## What next? After the Foundation activities have been completed

Once the children have worked through the Foundation activities they should be ready to move onto the Kit 1 and then Kit 2 activities. The Foundation activities worked on should have laid a firm foundation to the Kit 1 activities, when the children will start to use what they have learnt about maths. It is therefore very important that all Foundation activities have been well practised, and that the skills learnt are applied to other materials to aid generalisation. If they are able to talk about what they are doing with the materials they will be ready to move on to learning about the signs involved in arithmetic which are introduced in Kit 1.

If productive language limitations mean the activities have been completed without the child being able to explain what they are doing, it may be worth checking that this language is understood by the child before learning the signs that represent the vocabulary of arithmetic.

It is worth remembering that if the children are able to recognise and name the Numicon patterns and shapes (and this should be the case if they have worked through the Foundation activities) the materials can be used to support many areas of the maths curriculum.

## Conclusion

I hope that the ideas in this book have helped you in exploring the Numicon materials with your own child or the children you work with. The ideas are all ones that have worked for one or more children. You may find that you need to adapt the activities further for individual children, and it is hoped that the ideas reported here will help you to do this.

The author is always keen to hear about and share new ideas that parents and teachers have found useful. If you would like to share your experiences there are several ways of doing this:

- 1) the New Zealand based Yahoo e-mail discussion list (see page 51) is a growing community of people using Numicon with children with Down syndrome;
- 2) The Down Syndrome Educational Trust is always interested in publishing experiences in *Down Syndrome News and Update*;
- 3) post a message on the Numicon web site discussion board;
- 4) or the author can be contacted at: [jonye\\_uk@yahoo.com](mailto:jonye_uk@yahoo.com) and ideas will be included in training events and in any future revision of this book.

## Appendix: Case studies of children

The following are short profiles of the children with Down syndrome who took part in the study including details on the progress that they made on the Numicon activities and any changes in number skills that were observed either during visits to the schools, reported by teaching staff (in a questionnaire given out at the start of the study or during our observation visits to schools) or during standardised testing. Comments are also made on how often and for how long the children were using the materials and any significant observations made about the way the system was used by the school staff.

The children's age at the start of the project is reported in brackets after their name. All names are pseudonyms and as far as possible any details that may identify the child have been removed. As references are made to the month when events occurred it is important to note that information was collected from January to December in one year.

### Billy (5 years 2 months: Reception)

Billy attended a mainstream infant school and had not used Numicon before the start of the project. He did Numicon activities two or three times each week in school, plus was doing some at home with his mother, and enjoyed the activities once he had become familiar with them. A main focus for the school during this year with Billy was in implementing a behaviour plan to develop his attention, learning and social skills. Numicon was one of the most successful 'academic' activities he engaged with in school.

Over the year Billy worked on the following activities:

- Covering the Board (Activity 2): Continued throughout the year, started with overlays and by the end was able cover blank board and to see and fill gaps from at least 1-4.
- Matching the Shapes (Activity 1): sometimes shapes to shapes but often to large wall-chart number line. Billy was able to match at least the 1-7 shapes.
- Building Towers (Activity 12): at the start Billy was unable to add the pegs to the shapes but by the end of the year he was able to do so. His teaching assistants commented that his fine motor skills had improved over the year, and they thought this was helped by this activity as he was very motivated to take part. It became a frequent activity, and he was able to see some gaps left and fill with the correct shape.
- Find the Shape (Activity 3)/Copy the shape (Activity 4): this was tried a couple of times, and Billy attempted it, but did not enjoy it. His teaching assistants sometimes turned it into Fill the Holes (Activity 11).
- Feely bag: this was used during various activities, and Billy was sometimes able to name the shapes before taking them out of the bag.
- He used number name and colour to name shapes when working with them from the start e.g. "blue two".

Over the year an improvement in fine motor skills was seen, in recognising the Numicon shapes/patterns and in counting objects. At the start of the year in a test situation when counting 12 blocks he produced the count words '1-8, 10, 11', but not in one-one correspondence with the items. At the end of the year he counted '1-4' items correctly on the same task.

## Stephen (5 years 8 months: Year 1)

Stephen attended a mainstream infant school. He has significant hearing loss in addition to Down syndrome. Developing Stephen's behaviour, social and learning skills was a high priority for him in school this year. He enjoyed using the Numicon materials, and so behavioural issues did not impact on the implementation of the system.

He had already been using the Numicon materials for approximately 1 year 4 months. All children who had started to use Numicon before the project were asked to revisit the early activities to ensure that the system was being followed correctly, and that all activities were solidly learnt. According to the questionnaire that his teaching assistant completed he was already able to count objects to 5, and sometimes to 10 with help; was usually able to recognise, name and order the shapes from 1-5; and could sometimes recognise and name numerals from 1-10. He was starting to understand '1 more' with smaller numbers.

Numicon activities were done every day along with a variety of other number activities. Stephen's teaching assistant adapted the activities to make sure he was motivated to take part in them. The main Numicon activities were constantly extended by using different materials, and the materials were used to support class activities (e.g. doubles, one more). At the start of the year he was easily able to complete Activities 1 and 2, and by the end was proficient at Activity 5, almost solid on Activity 6, and working on Activity 7. His count word production had developed over the year, with more words being pronounced clearly.

Over the year Stephen worked on the following activities:

- Stephen was able to complete Matching the Shapes (Activity 1) and Covering the Board (Activity 2) in one attempt. Cover the Board continued to be used as a finishing off activity through the year.
- Give it a number (Activity 14)/Number the shapes (Activity 16): They start every session by laying out the Numicon shapes and number cards in a numberline at the top of the table. Stephen joins in where he can, but his teaching assistant does what is needed to finish this activity quickly. By May Stephen is more involved in this.
- Find the shape (Activity 3): In January he was able to complete this for 1-6, and by March he was able to do 1-10.
- Copy the shape (Activity 4): Stephen was able to do this for 1-5 in January and by February was able to do 1-6, but they moved onto Activity 5 as Stephen did not really like Activity 4.
- Make a pattern (Activity 5): In March Stephen was able to make 1-3 patterns. To start with in one session they completed the activity for 1-5 and then completed 6-10. In April when Stephen was confident with these separate sections they then did 1-10 in one go. They also did lots of extension activities – making patterns with other materials such as Compare Bears, buttons, Unifix cubes, etc.
- Making 10 with two shapes: Stephen started putting two shapes together, so his teaching assistant extended this activity to look at other ways of making 10 and checking with a 10 shape on top (May).
- Remember the pattern (Activity 6): Started in May, Stephen was not interested to start with, but after a couple of goes was able to produce 1-8 patterns. They gradually practised with different numbers and by June he was able to make 1-10 all in one go. After the summer break (8 weeks for Stephen) he was able to complete for 1-7. He was able to do 8-10 by September, but not always consistently, so they moved onto Activity 7 but returned to Activity 6 to practise.

- Jumbled shapes (Activity 7): Started at end of September, Stephen enjoyed messing up the order before putting in the correct order. They started with 1-5 (able to do by early October), and he was able to order 1-6 by mid-October.
- Build it Up (Activity 12): This was used in teaching sessions throughout the year, mixed in with the other activities to extend Stephen's experiences and explore the shapes further.
- Stephen's teaching assistant made her own number cards with the numeral, Numicon shape and number word on them (see page 26). These were used for lots of adapted activities, e.g. matching shapes underneath, starting off from a muddled order, adding Compare Bears underneath in the Numicon pattern.
- Stephen was introduced to the Cuisenaire rods (materials used in the Numicon kits 1 and 2) in May, which he started to play with as part of informal play activities.

### Jenny (6 years: Year 1)

Jenny attended a mainstream infant school and had already been using Numicon for approximately 1 year 6 months, however this was in an informal way and the structured system had not been followed. According to the questionnaire completed by her teaching assistant at the start of the year Jenny was able to count sets of objects to 5 but not consistently, was able to recognise the shapes from 1-10 but not consistently, and could recognise numerals from 1-5, and name them from 0-3.

They started off doing the Numicon activities every day following the structured system, but during the year this gradually changed so they were using the materials to support class activities, in particular to support learning number facts.

By the end of the year Jenny was able to name the 1-10 shapes, but not completely consistently. She was also able to put together shapes to make number facts to 10, and could talk about some of what she had done with prompts to do so. Naming numerals had extended to 6 with some assistance, and written numerals were usually matched to 1-10 shapes correctly. Her object counting skills over the year had not changed.

Over the year Jenny worked on the following activities:

- Match the shapes (Activity 1)/Jumbled shapes (Activity 7)
- Cover the board (Activity 2)
- Find the shape (Activity 3)
- Copying (Activity 4)
- Fill the gap (Activity 8)
- Fill the holes (Activity 11)
- Give it a number (Activity 14)
- Build it up (Activity 12)/Blocks of flats (Activity 27) – Jenny was able to add correct second shape to make 10, and if prompted could say the number fact she had made.
- The Feely Bag was used as an extension of activities.

### Alice (6 years 6 months: Year 2)

Alice had already been using the Numicon system for 2 years 4 months before the research project started, and so had considerable skills in knowing and using the shapes. According to the questionnaire completed by her teaching assistant at the start of the project she was already able to count objects to 29, and name and order the shapes and numerals from 1-10. She was able to do addition and subtraction within 10, and was starting to have mental recall of addition facts.

For any child who had already been using Numicon, we asked teaching assistants to revisit the early activities to ensure that the system was being followed correctly, and that all activities had been solidly learnt.

At the start of the year Alice was easily able to complete Activities 1, 2 (and with Feely Bag), 7-11, 13-17, 20, 21 and 27. They continued to work on some of these in order to practise shapes which Alice sometimes confused (7/9 and 8/10), and in order for Alice to practise explaining what she was doing, and both of these improved over the year (e.g. “10 take-away 6 equals 4” in November). Other activities (3, 5, 6, 19, 22) were solid to a certain range (e.g. 1-6) but needed further work to extend to 10. Some activities had been missed out or had not been reached so were completely new.

During the year Alice moved from a mainstream infant school to a mainstream junior school and a new teaching assistant starting working with her at this point. Numicon activities were usually done everyday.

By the end of the year Alice was working on Foundation Activity 42 – Subtraction, and working on reading numerals up to 100 (she still had some difficulties with teen/decade numbers), and counting in 2s, 5s and 10s. They were also working on multiplication (x2s) in class using the sum/answer cards that all the children were using, plus they used the Numicon shapes to support this.

### Adam (7 years 2 months: Year 2)

Adam had already been using the Numicon system for 1 year 4 months before the research project started, and so had considerable skills in knowing and using the shapes. According to the teaching assistant’s report he was already able to count objects to 30, was able to name and order the shapes and numerals from 1-10, and match the shapes to the numerals. He was able to name numerals up to 100 and was starting to have mental recall of addition facts.

For children who had already been using Numicon, we asked teaching assistants to revisit the early activities to ensure that the system was being followed correctly, and that all activities were solidly learnt. At the start of the year Adam was easily able to complete Numicon Foundation Activities 1, 3, 7, 8, 9, 10, 11, 12, 14, 15, 16 and 17.

During the year Adam moved from a mainstream infant school to a mainstream junior school, but kept the same teaching assistant. Numicon activities were usually done every day.

By the end of the year Adam had completed all the Foundation Activities except 43 and 44, and was working on Kit 1 counting activities. He still had some difficulties with confusing -ty and -teen numbers, so this continued to be a focused target, and they used the Numicon shapes to support this. They have also worked on learning about time, and Adam is able to count in 5s to 60, with the aim of being able to tell the time to the nearest 5 minutes. They were also working on multiplication (x2s) in class using the sum/answer cards that all the children were using, with support from Numicon shapes. Adam needs to develop his expressive skills so that he can explain what he has done in complete sentences and the Numicon activities are used to work on this.

### Jessica (7 years 7 months: Year 3)

Jessica attends a school for children with moderate learning disabilities and had not used Numicon before the start of the project. At first her teacher tried to use Numicon as a group activity, but felt that Jessica was not getting the support she needed, so tried individual sessions. However, it was difficult for them to find time to do this as she did not have a dedicated teaching assistant, and ended up doing it once or twice a week for 10-15 minutes. There were also some weeks where no Numicon activities were done. Initially Jessica did not want to engage in the activities unless it was one she really enjoyed

doing, but once she was familiar with the materials she participated well. In September she changed classes and again they tried Numicon as a group activity (2 or 3 times per week). At the start they had some difficulties as Jessica was more advanced than the others in the group, but they gradually found a way to make this work. They started by all the children doing the same activity, which gave Jessica a chance to practise familiar activities, and as the staff got used to the activities and the children's skills developed, they were able to differentiate the activities for each child in the group, or give them a different activity each.

By the end of the year Jessica was working on Activity 19. She was able to see the shapes and order and match them with the numeral cards to 10. She found the activities with the pegs (e.g. 3 and 4) difficult and she usually arranged the pegs in a line rather than in the Numicon pattern. (This difficulty was overcome during the second year of the project. No specific technique was used to do this beyond practising with the materials). An improvement in counting skills was observed over the year. When tested at the end of the project she was able to count a set of 12 blocks accurately, whereas at the start of the year she had said the count words 1-10 but not in 1-1 correspondence.

### **Michael (8 years 8 months: Year 4)**

Michael attends a school for moderate learning difficulties and had not used Numicon before the start of the project. He is bilingual, his speech is sometimes unclear, and it is not always clear which language he is using. Comments from teachers suggested that Michael was already good at and enjoyed number work, and at the start of the project they reported that he was able to give sets of 10 items. They did not start using Numicon until three months into the start of the project due to classteacher absence, then they did 10 minutes of practice most days, or at least two or three times per week. In September Michael changed class, classteacher and teaching assistant. They then started using Numicon as a group activity, and used the materials to support other class number activities. From observations and teaching staff reports Michael has really enjoyed using the Numicon materials, and the teaching staff has found them very useful for all the children in the group.

By the end of the year Michael was working on Foundation Activity 27 (Block of Flats), he was able to add the correct shapes, and was able to talk about what he had done if prompted. He was able to recognise the patterns, name the shapes, and order and match them with the numeral cards to 10. They were starting to use the shapes to create numbers beyond 10. When tested at the end of the project he was now able to count a set of 12 blocks accurately, whereas at the start of the year he had produced some count words, but not all used in the correct/standard order, and they were not used in 1-1 correspondence with the items.

### **Anthony (9 years old: Year 4)**

Anthony attended a mainstream primary school and had not used Numicon before taking part in the research project. As well as having Down syndrome Anthony also has a hemiplegia which causes him additional difficulties, both physically (movement restricted on one side of body and visual difficulties) and possibly with attention. His productive language is delayed, though constantly improving. He tended to learn new skills slowly and forget what he had recently learned, although he also made huge gains in his skills at other times. At the start of the year Anthony did not know all the colours used for the Numicon shapes so one teaching assistant worked on a specific project to teach these to him, and by the end of the year Anthony was able to say the colour names, though he did not always use them correctly. As Anthony did not know all the colour names and already used the number names from 1-10, teaching staff used these for the shapes straight away. By the end of the year Anthony was sometimes able to order the shapes (1-10) and see that shapes were missing when covering the board, however performance on all tasks was variable. At the end of the year he was working on a range of

Numicon activities (Activities 1-9, 14). Some days these were completed correctly using the shapes from 1-10 and other days errors were made. Anthony's count sequence using a numberline went up to 50 (at the start of the year it was up to 20 with some assistance). They also worked on time and money using various materials including real coins and flashcards, and using Numicon shapes to support this work (e.g. matching coins to shapes). He was able to name all coins by the end of the year, though this was not completely accurate.

When asked if the teaching assistants thought Numicon had helped Anthony, they were sure that it had made a difference to his understanding of number in other situations. Some examples include: in drawing the buttons on a clown, before he would have added lots but recently he added just a few, and in a favourite story about 3 owls he now recognised the 3 as being a number, and drew a picture of the 3 owls, whereas before he did not notice that element of the story.

### May (9 years 9 months: Year 5)

May attended a mainstream junior school and had already been using the Numicon system for 1 year 3 months (three times a week for  $\frac{1}{2}$  to 1 hour) before the research project started, and so had considerable skills in knowing and using the shapes. According to the teaching assistant's report she was already able to name and order the shapes and numerals, and match the shapes/numerals from 1-10. She was starting to be able to do addition and subtraction within 10 using the Numicon shapes.

For children who had already been using Numicon, we asked teaching assistants to revisit the early activities to ensure that the system was being followed correctly, and that all activities were solidly learnt. At the start of the year May was easily able to complete Activities 1-17, 19-22. So after checking through these activities once each, they started working from Activity 23.

In September, May changed classes, classteacher and teaching assistant.

By the end of the year May had worked through to Activity 38 (up to addition to 10, and subtraction of 1) and was also working on some Kit 1 Activities. May was able to describe creating imaginary towers, saying the sentences for number facts to 10 (Activity 27 – Block of Flats), indicating she was able to manipulate mental images of the shapes. They were working on extending count sequence using a number line (in June this was to 12 alone and 20 with support and by July this was up to 70). They were starting to use rods for some activities. Place value was starting to be worked on and she confused -teen and -ty numbers, so Numicon shapes were being used to support this. She was now able to count sets above 50, and find the number on the numberline. She was able to use addition and equals signs when writing sums. She could identify any number to 100 as being odd or even, with some difficulties with decade numbers. With money she was able to match coins to Numicon shapes, and make 5p out of 5 x 1p coins. They often made stories utilising the number work they were working on.

According to the standardised tests conducted at the start and end of the project May made considerable progress in her number skills over the year.

### Jack (9 years 9 months: Year 5)

Jack attended a mainstream junior school and had not used Numicon before the start of the project. At the start of the year Jack was working with one teaching assistant who was covering long term sick leave of his main teaching assistant, who returned in March. In September Jack changed classes and classteacher, but kept the same teaching assistant. For maths lessons Jack usually worked in a small group with one or two other children who did not have learning disabilities but who had specific difficulties with number work. The lessons were always designed to keep the children's attention and used materials and games to keep them motivated. Often simple activities were made motivating by making

them into a race or competition with the other children, and this worked well for all the children in the group.

Jack enjoyed numeracy prior to being included in the project, and showed relative strengths in this aspect of his development. By the end of the year he had worked through the Foundation Activities and had just started on Kit 1 activities, including using the Cuisenaire rods. As well as following through the Foundation Numicon activities they spent time on learning the count sequence to 100, which Jack was able to say and write by the end of the year. They also worked on counting in 5s and 10s, counting in 2s to 20, and counting backwards. He was able to identify odd/even numbers to 100. At the end of the year Jack still made some errors in confusing -ty and -teen numbers.

### Jane (11 years 9 months: Year 7)

Jane attended a mainstream secondary school and had not used Numicon before starting the project. As well as using Numicon at school she also used it at home with her mother for the duration of the project.

By the end of the year she was working on Activities 11 and 12 (Fill the Holes/Build it Up) and although she found the pegs difficult to manipulate she persisted with the activities involving the pegs, as she enjoyed working with the materials. With Activity 12 (Build it up) she was able to find the correct shape to complete the layer, but at this point her delayed speech meant she could not explain what she had done. She was also able to order the shapes/numerals from 1-10 (Activity 14 – Give it a Number), and add numerals to shapes when in a random arrangement (Activity 17 – extension). Copying peg arrangements were difficult for Jane to start with, but with practice she was able to do these activities.

When tested at the start of the study on counting 12 blocks she said the count words 1-10, but they were not in 1-1 correspondence with the items. By the end of the year she was able to count all 12 blocks accurately.

Although progress on the tasks was slow it was felt that Numicon had made a useful contribution to her maths work, and that she had developed important numerical skills over the year. Jane's thinking about numbers could be seen clearly when manipulating the materials, whereas her expressive difficulties had previously limited this assessment of her understanding and thinking.

### Hannah (12 years: Year 7)

Hannah attended a mainstream secondary school and had not used Numicon before the project started. She enjoyed using the materials and her teaching assistant used the materials in a creative, fun and sensitive way to meet Hannah's needs. By the end of the year Hannah had completed the Foundation activities and was starting on the Kit 1 activities. By the end of the project she was able to order the shapes and numerals from 1-10. She could also order numerals to 100, and in reverse order. She could count to 100 with a number square to support her, and in 10s, and do both of these in reverse. She was very able to talk about what she was doing with the materials. They had just started to use the Cuisenaire rods.

When tested at the end of the year she was now able to count in tens, do a pictorial multiplication sum (4x4), and do a pictorial subtraction sum, test items that she was not able to complete at the start of the study.

### James (12 years 7 months: Year 8)

James attended a mainstream secondary school and had not used Numicon before the project started. During the year James changed teaching assistants, but remained with the same maths teacher, who was very involved in his teaching. He was considered by his teachers and teaching assistant to have

good maths skills and to be very interested in it. James did not like working outside of the classroom, so he always did his maths and Numicon work in the classroom. No problems were reported in terms of the activities being distracting to the other children, and at times the whole class joined in the activities e.g. each child holding one of the shapes to create a number line and going out of the room to do Activity 8 (Fill the Gap).

James enjoyed using the Numicon materials straight away and was soon naming the shapes by their number names. At times he found the pegs frustrating to use, due to difficulties with fine motor coordination. He also has visual difficulties so some materials were difficult for him to see. He completed almost all the Foundation activities in the first session each one was tried, and all were completed by the middle of September. The following activities needed more practice: 22, 24 (10-20), 31, 34. He did not do any Numicon activities for about 10 weeks between April and June, so they revisited earlier activities and he remembered all the shapes and how to order them. He particularly enjoyed activities involving the Feely Bag (although it was too deep for him, and he did not like his arm going in so far, so it had to be supported on the table) and those using the spinner.

From the end of September they started working through the Kit 1 activities. By the end of November he had completed the following activities, and was usually successful on the first session on each activity:

- Pattern – creating aba patterns, assigning numbers to them, and predicting what will come next in the sequence, using relationships between rods to know if this is 1 what is the next one, adding 1 more (1-10) using Multilink and recording on paper
- Counting – number names to 100 already known and now starting on numbers beyond 100, counting backwards (he could count from 6-1), create number line to 20 using shapes, able to count up to 46 items, making teen numbers using shapes and numerals, how many without counting above 10, using plus and minus with 0, 1 and 2 to move along a number line/number square (James quickly realised he would win if he got pluses all the time, so he cheated with the spinner to get pluses!)
- Arithmetic – adding and starting to record written sums, addition sign – this was already known, subtraction sign – subtraction was hard for James to say, so they continue to use “chop off” and “take away”, but he understands all terms, money – creating values of money up to 7p, adding and subtracting 2.

### William (13 years: Year 8)

William attended a mainstream secondary school and had not used Numicon before the start of the project. There were staffing difficulties in the school at the start of the project, so they did not start using Numicon until three months into the project. The school planned that William would spend half each maths lesson in the classroom working on classwork and then half outside the class working on Numicon activities. Occasionally staffing difficulties and other school activities meant that Numicon activities were done less often than was initially planned for. In total 42 Numicon sessions are recorded, over 29 weeks of school time.

By the end of the year he had worked through most of the Foundation activities. According to the school's records many activities only needed to be tried once or twice, and others a maximum of four times, before William fully succeeded, therefore he worked through the activities very quickly. In the first session William was able to match the shapes, after a few sessions was able to order the shapes to 10, and on the first attempt was able to match the numerals with the shapes. By the end of November he could complete addition up to 10 using the shapes, and was starting to understand that adding one makes the next number, and starting to understand subtraction. His recognition of the shapes

remained variable and he would sometimes resort to counting to work out an answer (e.g. when doing subtraction and needing to recognise the shape left).

From William's performance on the standardised test at the start and end of the year it would appear that he had acquired or consolidated more basic numeracy skills, as he succeeded on some of the early items during the second test that he had failed on the first test. This would be in keeping with the Numicon curriculum experienced until November i.e. it did not extend past the skills William already had in January, but did fill in some gaps. This was supported by comments from the teaching assistants working with William who thought that the system was useful for checking gaps in the students' experiences.

### Edward (13 years 2 months: Year 8)

Edward attended a mainstream secondary school and had not used Numicon before the start of the project. Due to difficulties with teaching staff allocations at the start of the year, they did not start using Numicon until the third month of the project. The school planned that Edward would spend half of each maths lesson in the classroom working on classwork and then half outside the class working on Numicon activities. Occasionally staffing difficulties and other school activities meant that Numicon activities were done less often than planned for. In addition, Edward was able to access the majority of the maths lesson work so that he would often stay in class to continue with that work, rather than coming out of class to use Numicon. In total 37 Numicon sessions are recorded, over 29 weeks of school time.

By the end of the year he had worked through most of the Foundation activities, however according to the records many activities had only been tried once or twice, and it was not clear if all were solidly learnt before moving on. Edward was able to recognise and name the shapes (including when they were presented to him briefly as a test), but he continued to occasionally count the holes to identify the bigger shapes (6+), perhaps reflecting a lack of confidence in identifying the shapes by sight and using a more practised skill i.e. counting. He was soon able to order the shapes to 10 and add numerals, and by the end of the year could complete addition up to 10, and understood that adding one makes the next number. Edward had good productive language skills and was usually able to describe what he was doing as the activity took place and at its end.

### John (13 years 10 months: Year 8)

John attended a mainstream secondary school and had not used Numicon before the start of the project. John has delayed expressive language and some social communication difficulties. There were staffing difficulties in the school at the start of the project, therefore they did not start using Numicon until the start of March. John would usually spend between 15 minutes and the whole 50 minute maths lesson on Numicon activities (depending on his interest in the activities), two or three times per week. By the end of the year he had worked through all of the Foundation activities, and had just been given the Kit 1 activities to start working with. According to the teaching assistant records many activities had only been tried once or twice, however from observation visits it was clear that they were practising the activities more often than the records suggest. The teaching sessions often went beyond the Foundation activities and the materials were used in creative ways to explore areas that John was interested in.

John was able to match the shapes, order the shapes to 10, match the numerals with the shapes and name the shapes on the first attempt. By the end of November he could complete addition and subtraction up to 10 and beyond using the shapes, and understood that adding one makes the next number. He was starting to use the shapes to work on counting in 10s up to 100 and to make numbers from shapes above 10. His teaching assistant commented that using the Numicon materials had

really improved his basic understanding of numbers, and it was really helping with numeracy work in other lessons (e.g. using ideas developed in Numicon activities he was able to understand graphs in geography).

## Reference list and resources

### General Number and Down syndrome

- Bird, G. and Buckley, S. (2001). *Number skills for individuals with Down syndrome – An overview*. Portsmouth, UK: The Down Syndrome Educational Trust.
- Bird, G. (2001). *Number skills development for infants with Down syndrome (0-5 years)*. Portsmouth, UK: The Down Syndrome Educational Trust.
- Bird, G. and Buckley, S. (2001). *Number skills development for children with Down syndrome (5-11 years)*. Portsmouth, UK: The Down Syndrome Educational Trust.
- Bird, G. and Buckley, S. (2002). *Number skills development for teenagers with Down syndrome (11-16 years)*. Portsmouth, UK: The Down Syndrome Educational Trust.
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- Horstmeier, D. (2004). *Teaching Math to People with Down Syndrome and Other Hands-on Learners*. Bethesda, MD: Woodbine House.

### Numicon

- Buckley, S.J., Horner, V., Wing T. and Bird, G. (2001). The Numicon Approach. *Down Syndrome Association Journal*, 98, 18-22.
- Ewan, C. and Mair, C. (2002). Wiltshire Pilot Project - Numicon (March-July 2001). *Down Syndrome News and Update*, 2(1), 12-14.
- Horner, V. (2002). Numicon, numeracy and a special need. *Mathematics Teaching*, 179, 28-31.
- Lander, A. (2006). Feely Bags. *Down Syndrome News and Update*, 6(1), 14-15.
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- Saunders, E. (2004). Number fun? You can count on it! *Down Syndrome News and Update*, 4(1), 11-14.
- Tacon, R., Atkinson, R. and Wing, T. (2004). *Learning about Numbers with Patterns: Using structured visual imagery (Numicon) to teach arithmetic*. London: BEAM Education. (<http://www.beam.co.uk/pdfs/RES04.pdf> or 'Articles and research' page on <http://www.numicon.com>)
- Uttley, W. (2003). Introducing numbers and Numicon to young children who find it difficult to sit and concentrate. *Down Syndrome News and Update*, 3(1), 18-19.
- Uttley, W. (2004). An update on Sam and the progress he had made in numeracy using Numicon. *Down Syndrome News and Update*, 4(1), 15-16.
- Wing, T. (2001). Serendipity, and a special need. *Mathematics Teaching*, 174, 27-30.

## Time

See *Down Syndrome Issues and Information* Number books and chapter in Horstmeier book (see above).

A set of photocopiable worksheets that break down the teaching of time into small steps, that some children with Down syndrome have found useful:

Time Cracker (£55 plus P&P) [http://www.strath.ac.uk/qie/qie\\_publications.html](http://www.strath.ac.uk/qie/qie_publications.html)

## Money

See Numicon Kit 1 for how to use to teach money skills.

See *Down Syndrome Issues and Information* Number books and chapter in Horstmeier book (see above).

## General number resources websites

Beam Education (specialist mathematics education publisher) <http://www.beam.co.uk/>

Spare Chair (for support assistants) <http://www.spare-chair.com/>

SEN Teacher (lots of excellent printable resources) <http://www.senteacher.org/>

Online number games: (<http://atschool.eduweb.co.uk/toftwood/resources.html>)

BBC education pages (<http://www.bbc.co.uk/education> and <http://www.bbc.co.uk/cbeebies/>)

## Reading and writing and Down syndrome

Buckley, S. (2001). *Reading and writing for individuals with Down syndrome – An overview*. Portsmouth, UK: The Down Syndrome Educational Trust.

Bird, G. and Buckley, S. (2001). *Reading and writing for infants with Down syndrome (0-5 years)*. Portsmouth, UK: The Down Syndrome Educational Trust.

Bird, G., Beadman, J. and Buckley, S. (2001). *Reading and writing for children with Down syndrome (5-11 years)*. Portsmouth, UK: The Down Syndrome Educational Trust.

Bird, G. and Buckley, S. (2002). *Reading and writing for teenagers with Down syndrome (11-16 years)*. Portsmouth, UK: The Down Syndrome Educational Trust.

## General education and Down syndrome

For details of the other books in the *Down Syndrome Issues and Information* series published by The Down Syndrome Educational Trust, please see downsed online at <http://www.downsed.org/Publishing/dsii/education/books/>

## Details of other Numicon projects

**Down syndrome:** Wendy Uttley - Down Syndrome Support Group Bradford, E-mail: [downsgroup@tiscali.co.uk](mailto:downsgroup@tiscali.co.uk)

**Down syndrome:** A Numicon project is being led in New Zealand by Margi Leech (Margi's website: [www.numicon.co.nz](http://www.numicon.co.nz) and email: [margi@numicon.co.nz](mailto:margi@numicon.co.nz)). As part of this project they have set up a discussion list, and although based in New Zealand it has a growing international membership, including Margi, Romey Tacon and Jo Nye. This is a useful place for sharing experiences and for problem solving: <http://groups.yahoo.com/group/numiconz/>

**Mainstream schooling:** Devon EAL have recently produced a small guide ('An Image of Number') based on their experiences in using Numicon in mainstream classes, which can be used as a supplement to the Numicon teaching books. (Available from: <http://www.devon.gov.uk/eal/catalog/>)

**Mainstream schooling, Wave 3 children in Key Stage 2 and 3:** Leeds Education, UK conducted a pilot project using Numicon and other multisensory methods with children who have been identified as requiring Special Educational Needs support. Report of the project can be found on the Numicon website: <http://www.numicon.com/pages/articlesandresearch.aspx>

**Mainstream schooling, Wave 3 children:** Brighton UK project, contact: [susan.saunders@brighton-hove.gov.uk](mailto:susan.saunders@brighton-hove.gov.uk)

### **Numicon Ltd**

The Numicon website includes details of all their products, a demonstration version of the interactive whiteboard software, plus there is a discussion board for posting queries and sharing resources.

Web site: <http://www.numicon.com/>

Address: Numicon Ltd

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Avis Way  
Newhaven  
East Sussex  
BN9 0DH

UK Freephone: 0800 597 7470

Telephone: +44 (0)1273 515591

Fax: +44 (0)1273 515592

E-mail: [info@numicon.com](mailto:info@numicon.com)

### **Resources that also make use of patterns to represent numbers**

- The patterns used in the Numicon system were originally devised by Maria Montessori and have been used in maths resources for many years, notably by Catherine Stern and Unifix/Multilink. You can make use of these materials to extend and generalise the activities suggested in the Numicon activity cards. The patterns have also been used in the computer software package 123-CD (Sherston Software Ltd.) and you may notice more resources that do the same.
- Paul Ford has created a domino activity using Numicon shapes rather than numbers. These can be used in a variety of ways i.e. as normal matching dominoes, or put together two shapes that make 5 to develop number facts. <http://www.teachingideas.co.uk/maths/files/numicondominoes.pdf>
- 100 ideas for using Numicon: [http://numeracy.cumbriagridforlearning.org.uk/index.php?category\\_id=55](http://numeracy.cumbriagridforlearning.org.uk/index.php?category_id=55)

# Diagram to guide progress through the Numicon scheme

The following diagram provides a guide to how to work through the Numicon Foundation activities. It is based on the advice found in the Numicon Foundation scheme itself. Additional activities not covered by the Numicon scheme, such as count word sequence production are also included.

Further details on how to work through the scheme can be found on page 4 of this book.

